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CONCRETE & STUCCO HOUSES

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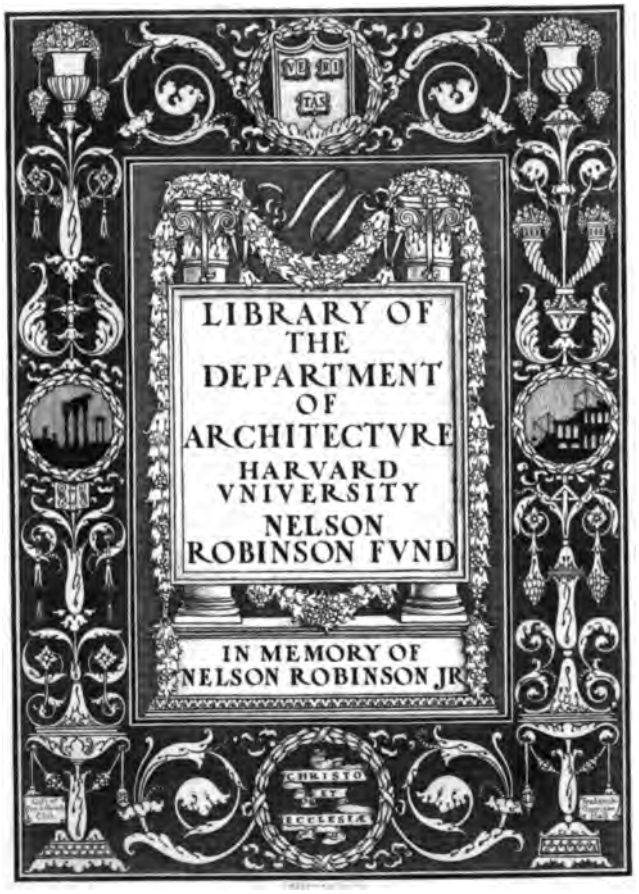
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The success of concrete or stucco houses will depend in the future upon a judicious use of color, probably obtained by the use of colored sand or gravel in the wall and in the form of inset panels, as in this illustration showing the residence of Mr. Gage E. Tarbell, Nassau Boulevard, L. I.

CONCRETE AND STUCCO HOUSES

THE USE OF PLASTIC MATERIALS IN THE BUILDING OF COUNTRY AND SUBURBAN HOUSES IN A MANNER TO INSURE THE QUALITIES OF FITNESS, DURABILITY AND BEAUTY

BY

OSWALD C. HERING

AMERICAN INSTITUTE OF ARCHITECTS

NEW YORK

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1912

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Preface

IT may be well to save the reader from idly speculating as to why the illustrations in this book have been limited to the works of American architects, when there exist in foreign countries so many masterpieces from which beautiful examples could be drawn. When the text was completed and the illustrations selected they were submitted to the publishers under the comprehensive title, "The Use and Abuse of Concrete and Stucco in Their Application to the Rural and Suburban Architecture of America," which title, while explicit, was too unwieldy for practical use.

I wish to acknowledge my indebtedness to the architects and others who have so courteously supplied illustrations of their works; to Mr. Henry H. Saylor, for valuable suggestions in the arrangement of this book; to my father, Dr. Rudolph Hering, and to Mr. Albert Moyer, for dissipating the clouds that obscured several technical peaks; and to my partner, Mr. Douglass Fitch, for his cordial aid in supervising the drawings of the constructional details.

OSWALD C. HERING

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CONCRETE AND STUCCO HOUSES

Introduction

THE need of a clearer comprehension of the use and abuse of concrete and stucco than is possessed by the average individual, including not a few architects and builders, has led to the preparation of this little book wherein the author has attempted a brief description of the composition of these two building materials, citing the various methods of their application to the solution of problems in domestic architecture and indicating how they may be made to contribute to the realization of a native style. Although in city residences, commercial buildings, bridges, subways, reservoirs and many other types of structure, concrete and stucco are advisedly employed, the greatest artistic success with the use of these materials has been achieved so far in country homes, their gardens and outbuildings.

While concrete and stucco have been factors in building construction for centuries past, the recent economic production and more general use of Portland cement has endowed them with properties that have so materially enlarged their sphere of usefulness that they are regarded in the light of new products. The very fact, however, that added strength and durability has been given to them by this powerful medium, has encouraged ignorant and unscrupulous persons to disregard its limitations, as innumerable examples of faulty design and construction bear witness.

Properly composed and applied, stucco becomes a legitimate covering for the protection and beautifying of porous and unsightly walls.

Properly mixed and formed, concrete is the most sanitary and durable of all building materials, and is susceptible of great beauty when care and judgment are exercised in the selection of aggregate (the sand and gravel used with the cement) of suitable size and agreeable color.

It is hoped that the statements and deductions contained in the following pages may lead to a better understanding of the properties of these two materials, to a fuller appreciation of their structural and esthetic attributes, and to a more general recognition of their ready adaptability to the logical development of American Architecture.

Country and Suburban Development

BEFORE launching into the description of the composition, use and possibilities of concrete and stucco in house construction, it would be well to cast an eye over the field that promises the greatest encouragement to domestic architecture: the countryside, accessible and available since the advent of the automobile, and still undefiled by the speculative builder; and the suburb, the compromise of the daily toiler with his love of nature, and mostly marred by the absence of comprehensive schemes of development.

We have heard a great deal about our ugly cities, barren of architecture, disfigured and dishonored by the speculative builder. For years past buildings stupidly designed and criminally built have been our closest acquaintances. From time to time an intrepid architect has conceived a "City Beautiful," only to have his plan ridiculed, denounced or quietly shelved. Recent years, however, have brought about a marked change in the attitude of the public toward the field of art. By reason of the lower cost and greater ease of travel, the accessibility of books and pictures, and through the power and influence of those strange hybrids of virtue and villainy, the daily newspapers, the people of our land are beginning to learn that good art is a good investment. A well-planned commercial building with a pleasing façade will generally attract more tenants of a better class than a building in the design of which no intelligent thought or skill has been employed.

But while evidence abounds of more than a dawning appreciation of good urban architecture, and popular feeling akin to personal injury and shame is aroused over any new disfigure-

ments of our cities and towns, the prostitution of the suburb and the countryside continues. Here and there is seen the guiding spirit of some individual, or company of men, of culture and foresight, endeavoring to reclaim the debauched settlements of the speculative builder and to inaugurate new developments upon a sound and worthy basis. A number of suburban tracts of land are now undergoing this wise and providential process of reclamation. Originally laid out with no consideration for future growth and appearance, cut up into narrow building lots and sold to speculative builders who erected thereon houses through which the elements whistled a dismal dirge to the expectations of the trusting purchasers, these properties present a sad spectacle of nature misunderstood and abused.

Although this blindness to, and contempt for, the wonderful possibilities of beautifying our suburbs and country estates still exists, and deceptive real estate projects continue to flourish, and through ignorance or sheer brutality the land and building speculator goes on with his destructive work, there is happily a vigorous movement on foot to put an end to the desecration of the city's environs and to give fuller protection to the suburban and country home-seeker. Successful developments, where intelligent workmanship has been employed, are now not uncommon, proving that a proper conception of landscape and building, executed in a thorough, workmanlike manner, is good business.

Some years ago the author, with the avowed purpose of giving a practical demonstration of what were then mostly theories, purchased a small suburban lot in a sparsely settled community fifteen minutes from the nearest railroad station, and built thereon a house designed to meet the requirements of his family, at the same time adapting it to the needs of the average suburbanite. Well built and equipped, and of a style of architecture suited to its purpose and environment, this house proved to be a comfort-

Albermarle Park, Asheville, N. C. *Samuel Parsons, landscape architect*

"The grades are steep and demand winding roads of which advantage has been taken to produce natural woodland effects"

"His ideal for this whole landscape is to make it somewhat like an English park and somewhat like an arboretum"

Two views of "Lyndanwalt," Abington, Pa. *Oswald C. Hering, architect*

"No cast-iron system of botany will be allowed to spoil the view"

able home, sufficiently agreeable in the arrangement of rooms, proportion and color to attract attention. Such houses as already stood in the neighborhood were mostly products of the village carpenter, of no design, poor in construction and lacking those essentials which distinguish a mere house — a collection of rooms juggled together in haphazard fashion — from a home, where time, thought and care have been expended in planning an interesting and practical structure inside and out. Within four years there grew up about this "pioneer" a dozen or more homes, all well built and some with conspicuous architectural merit which materially enhanced both the beauty and value of this and neighboring properties. The "pioneer" was then sold at a handsome profit, considerably greater than the advance in realty values would account for. The author's expectations had been more than realized.

In domestic architecture the ultimate cost is not generally of such paramount importance, for example, as in commercial work, where the revenue from the investment is the principal cause of the building. Questions of sentiment and the indulgence of personal fancy often run up the cost of a private dwelling after the work has begun, a ruinous course were the project a business venture pure and simple. In the development of a tract of land for domestic purposes the fact that the cost of the undertaking is of the first importance must not be lost sight of. In other words, the proposition is a commercial one, even though the product is for domestic use. To combine artistic excellence with honest and efficient workmanship, and place both upon a paying basis is, therefore, the problem that confronts the professional adviser of the men whose money he proposes to spend in planning for the future homes of the city's population; a grave responsibility, one which will require of the architect even a broader education and a more general knowledge of affairs than are commonly expected of him.

There are many large land development companies now operating in the environs of our cities, and their recognition of the architect's services in both executive and consulting capacities is becoming more general in all classes of suburban property. This comparatively new field for the architect's labors has possibilities of the greatest interest and importance both to himself, to real estate companies and to the general public. The trend to the suburbs and country is unmistakable. The era of the cave dweller is passing. Improved transit facilities have brought country property to the city's door, and a man of average intelligence with a few thousand dollars saved up has no longer any difficulty in securing as a good investment a site within reasonable commuting distance of the city's center, and in having a comfortable and attractive home built which he can dispose of, if necessary, at a profit exceeding that of the rise in value of the land.

In contrast to the "hit or miss" methods of the average suburban real estate promoter, the author calls attention to the five tracts of land illustrated in this chapter, each one representing a comprehensive plan evolved from a careful and intelligent study of the topography and the needs of the prospective community.

Albemarle Park at Asheville, North Carolina, consists of thirty-six acres situated on the slopes of a mountain about a mile from the center of the city. The grades are steep and demand winding roads, of which advantage has been taken to produce natural woodland effects whereby the essential beauties of the place are retained. A sufficient number of open spaces provide for the location of an inn and of a group of cottages, to each of which has been allotted a proportionate amount of lawn, shrubbery and flowers.

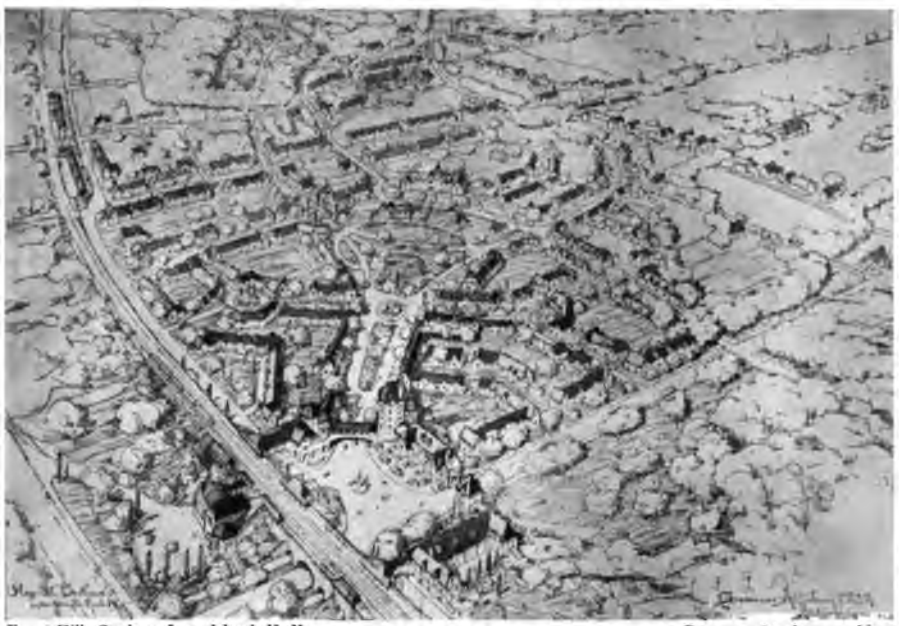
"Lyndanwalt," in Abington, Pennsylvania, presents a similar topographical problem in its two-hundred-odd acres of rolling

"Lyndanwalt," Abington, Pa. *Oswald C. Hering, architect*

"Notice how snugly it fits the landscape owing to the background of woods. Put that house in the pasture near the middle of the picture and half its attractions would be gone"

"Lyndanwalt," Abington, Pa. *Oswald C. Hering, architect*

"His social ideal is to have about a dozen congenial neighbors who will do nothing to ruin the landscape"



Forest Hills Gardens, Long Island, N. Y. *Grosvenor Atterbury, architect*
Olmsted Bros., landscape architects

"Forest Hills Gardens is an interesting example of co-operative design wherein the owner has engaged the services of men experienced in real estate development, domestic architecture, landscape design and sociology"

meadows and woodland in the Huntington Valley, scarcely forty minutes' train ride from the heart of Philadelphia. Here the building restrictions are hide-bound. The owner controls the situation by his determination to limit the "development" to about a dozen congenial neighbors who will respect the landscape and contribute to the enhancement of its beauty. The following published comment of Wilhelm Miller, the horticulturist, upon the location of the first house built for sale in Lyndanwalt, indicates the scope of this interesting experiment.

"I have visited Lyndanwalt at every season of the year and have come to know the owner's ideals. They are very different from those of the unhappy people who have half a dozen houses but no home because they have no interest in the land. Mr. H—— has about seven ideals in the development of his home — a social ideal, and an ideal for his park, his grove, his lake, his rocks, his woods and his pastures.

"His social ideal is to have about a dozen congenial neighbors who will do nothing to ruin the landscape. Therefore he has set aside about seventy-five acres for future neighbors, each of whom may have five to eight acres. The whole area has been carefully considered by a landscape designer so that everything will be harmonious. As an example of the problems which delight Mr. H—— and every true country gentleman, consider the placing of house No. 1, the first house that Mr. H—— has built to attract neighbors and to show what the aim of the colony is. Notice how snugly it fits the landscape, owing to the background of woods. Put that house in the pasture near the middle of the picture and half its attractiveness would be gone. Again, the horizontal lines of the house harmonize with the plateau on which it stands. Put the house on the hillside near the vegetable garden, and it would not fit at all. Perhaps such considerations do not appeal to you. Very well, you could not buy this house. Mr. H—— can and will wait five or even twenty years, if necessary, until he finds someone who does believe in making a house harmonize with its environment, instead of standing out in strong contrast, as most American places do.

"His ideal for this whole landscape is to make it somewhat like an English park and somewhat like an arboretum. It will be like a park in having generous open spaces and grazing cattle. It will be like the Arnold Arboretum on a small scale in having as many kinds of trees as is proper, and each genus by itself so far as practicable, but native trees dominant everywhere. No cast-iron system of botany will be allowed to spoil a view. So, too, with the villa sites. On one particular knoll no house will be allowed, because it would cut off the best vista of the valley."

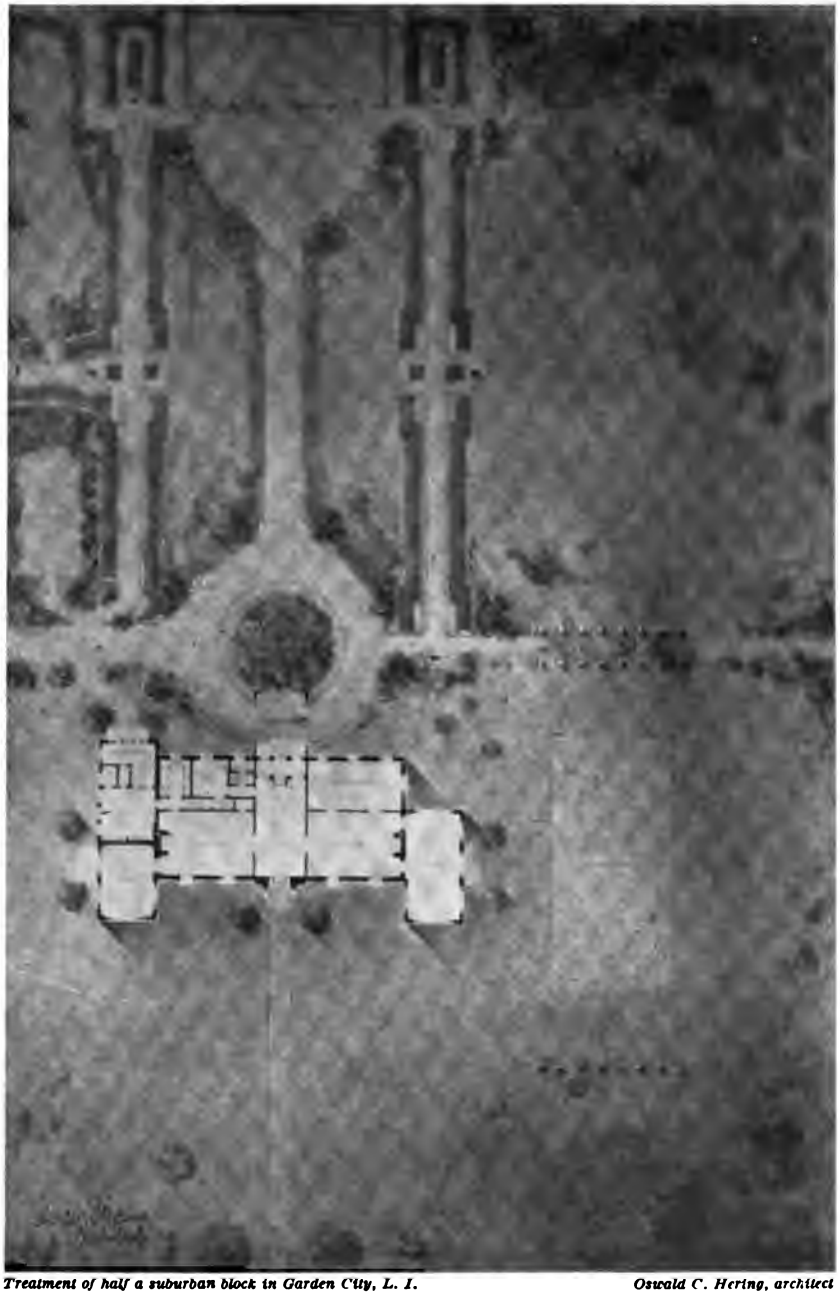
It is worthy of record that Mr. H—— had scarcely more than a year to wait before effecting a satisfactory sale of House No. 1 with the ten acres allotted to it.

Forest Hills Gardens, a tract of 142 acres near Jamaica, Long Island, and not over fifteen minutes' ride from the Pennsylvania Station in New York City, is an interesting example of co-operative design wherein the owner, the Sage Foundation Homes Company, has engaged the services of men experienced in real estate development, domestic architecture, landscape design and sociology, to lay out and establish a "garden city" as an inducement to people of moderate means to give up the cliff-dwelling life in the city's flats and tenements, and, at no greater expense or sacrifice of time in traveling back and forth, to acquire an individual home in a healthful and attractive environment. The undertaking is primarily a business enterprise, although it has a distinct educational purpose. If it proves to be a profitable venture, there is no doubt that the same ideas will be extensively employed in future developments, for the underlying principles are excellent.

The Company believes that buildings of tasteful design, constructed of brick, concrete or other permanent material, even at greater initial cost, are really more economical, by reason of their durability and the lower cost of maintenance, than the repulsive, poorly built structures which are too often found in New York's

Garden City, L. I. *Chas. W. Leavitt, Jr., engineer*

"The problem in Garden City presented no physical difficulties"



Treatment of half a suburban block in Garden City, L. I. *Oswald C. Hering, architect*

"There are many large land development companies now operating in the environs of our cities and their recognition of the architect's services in both executive and consulting capacities is becoming general"

outlying districts. The restrictions are necessarily severe in order that the aim in creating a homogeneous and congenial community may be fulfilled. References are required and a thorough investigation made of the character and standing of each applicant. Plans of proposed houses must be approved by the Company and conform to the standard of architecture established by the buildings already erected. Among the distinct innovations is the setting apart of certain portions of the property for groups of connected houses, the single architectural composition being proportioned to the size of the site. So designed and spaced, these groups of buildings will enhance the appearance of the property as a whole and lend to it an interest and variety not obtainable in detached dwellings set near together or built up in "blocks" between street lines. Certain areas have been set apart for the common use and enjoyment of the residents, in the shape of a public Green, the Station Square, small public parks and, finally, several enclosed private parks occupying the interior portion of some of the blocks and intended for the exclusive use of those living on the surrounding lots, especially for the smaller children, who consequently are not forced to play upon the streets. These enclosed playgrounds are reached directly from the back yards of most of the houses in the block.

In laying out the property the landscape designer has striven to secure the full benefit from two other important principles of city planning. The first relates to the main thoroughfares, which should be direct, convenient and of ample width and carefully related to the topography. The second relates to those streets which are not needed as thoroughfares, and which should be planned and constructed to discourage their use as such, and to meet the purpose of quiet, attractive residence streets, narrow and winding, giving to them a cozy, self-contained domestic character in contrast to the straight, open, wind-swept thoroughfares devoted to traffic.

The problem in Garden City, Long Island, presented no great physical difficulties. The land is a flat, open, treeless plain with a foot or more of rich soil covering a deep bed of gravel. But this very absence of hills and dales and trees and rocks removes one of the incentives for the engagement of an architect and landscape designer. It is so simple, reasons the promoter, why pay for professional advice? With a brass-bound scale and 6H pencil he himself "designs" the beautiful checkerboard of streets, avenues and boulevards, all bordered with cement sidewalks and picketed with inch-and-a-half alternating poplars and pin oaks, at $1.50 each, careful to make each "block" divisible by twenty, the "irreducible minimum" in building lots, and — presto! — the property plan is ready for distribution among the hungry salesmen.

That such methods were improved upon in the planning of Garden City, despite the simplicity of its topography, is evidenced by the accompanying illustrations.

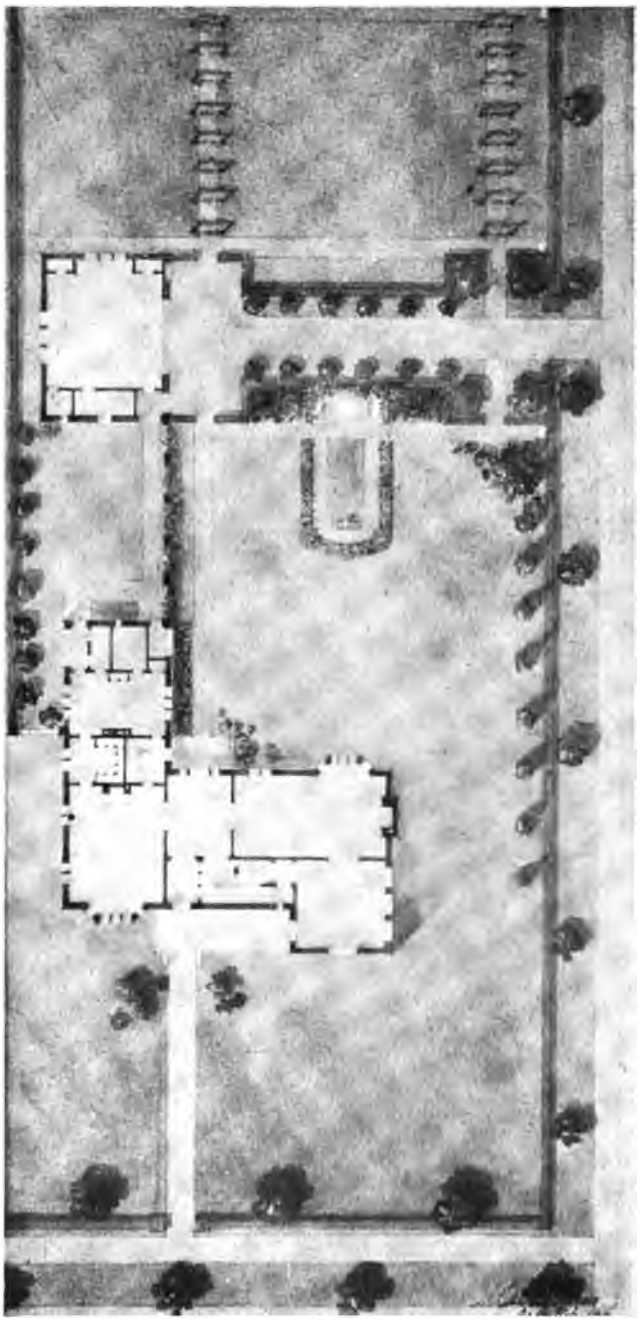
Jamaica Estates is a beautiful stretch of woodland within the limits of New York City, prolific in vistas and verdure by reason of skillful planning and planting. This property and a large undeveloped acreage to the east is destined to become one of the most beautiful residential parks in America, provided no liberties are taken with the landscape, and the restrictions upon the type of dwellings are rigidly enforced.

A residential park noted for its beauty and general excellence in the plan and structure of its streets and dwellings is Roland Park, Baltimore, Md. To country and suburban real estate promoters who claim that restrictions upon the kind and quality of the architecture is "impractical" and would prevent a ready sale of the land, the following extract from the printed restrictions of Roland Park should be of interest:

"A drawing showing the location of the house on the lot, the proposed finished grades, and the relative levels of the lot and

Treatment of a long narrow plot in Garden City, L. I.

Oswald C. Hering, architect



"Successful developments are not now uncommon where intelligent workmanship has been employed, proving that a proper conception of landscape and building executed in a thorough workmanlike manner is good business"

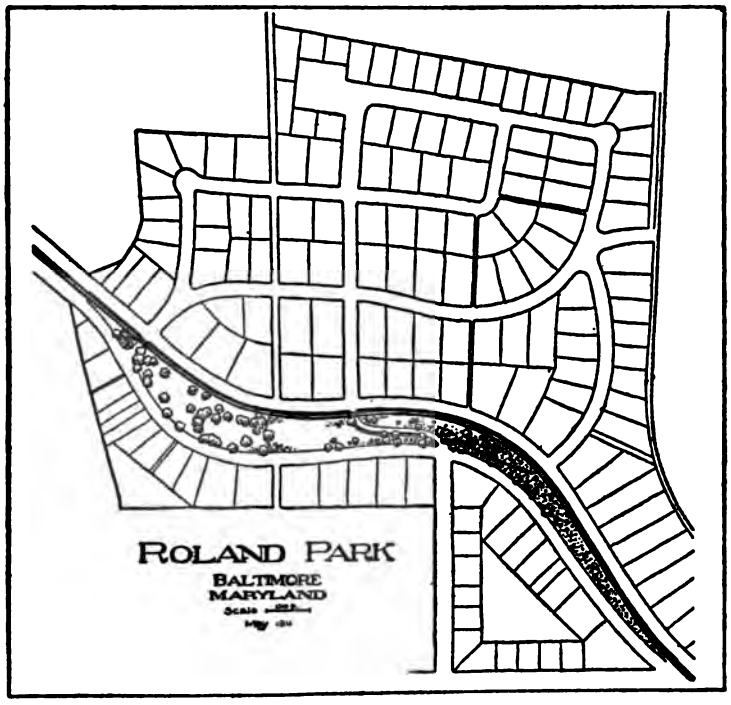
"No residence shall be erected costing less than . . . thousand dollars: the exterior . . . walls shall be of brick, stone, concrete, stucco of other material of similar character"

Two views of a section of Roland Park, Baltimore, Md. *Edward L. Palmer, Jr., architect*

"If any building is erected such building shall be made according to plans (including exterior color scheme, grading and location of building) approved by Roland Park Company"

street grades of the first floor, must be furnished before the Company can consider the working drawings for approval.

"In order to avoid, as far as possible, needless work and expense, the Company will consent to a tentative consideration of preliminary sketches. Such consideration is, however, distinctly



A lot plan of Roland Park, Baltimore, Md., where the gridiron system of dividing the land into precisely symmetrical lots has not been followed

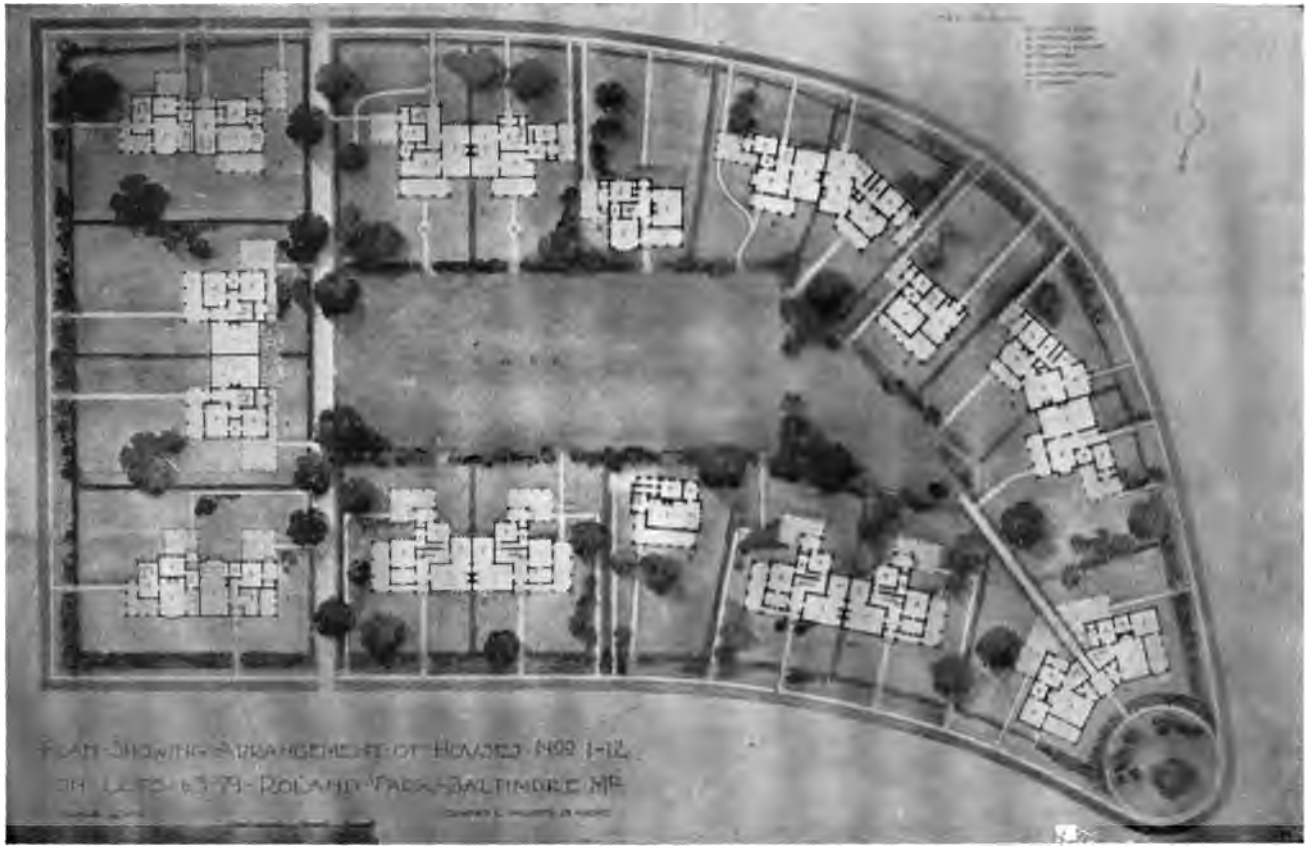
tentative, and approval of plans can be based only upon the completed working drawings from which the house is to be built.

"When the house is to be located on a corner lot, either it should have its principal entrance toward the street on which the lot normally fronts, or, if the entrance is to be on the side street, care must be taken that the house be so designed that it does not back up against the adjoining lot to the detriment of the latter.

"No residence or dwelling-house shall be erected costing less than ——— thousand dollars; the exterior exposed surfaces of

the walls, with the exception of trims and moldings, shall be of brick, stone, concrete, stucco, or other material of similar character, and if any building is erected, or any alterations made, such building or such alterations shall be made according to plans (including exterior color scheme, grading plan, and the location of such building) which shall have been approved by Roland Park Company."

Thus Nature, many times rebuffed, still lingers invitingly near. Close to the marts of our daily toil she presents opportunities for the most healthful enjoyment of life. From the city, with its architecture compact and towering in the crowded districts, to the country, with its wooded hills and flowering plains, its inland waterways and endless seashore, there is a promise of wonderfully beautiful dwelling-places for mankind. To achieve future distinction for our municipalities and rural districts is the task of the people, aided by the real estate operator, the architect and the engineer, whose services must be of a character to warrant the confidence and respect of those who will of necessity furnish the "sinews of war."



Plan of a section of Roland Park, Baltimore, Md. *Edward L. Palmer, Jr., architect*

"A residential park noted for its beauty and general excellence in the plan and structure of its streets and dwellings is Roland Park, Baltimore, Md."

Residence of Robert Cluett, Esq., Williamstown, Mass. *Winslow, Bigelow & Wadsworth, architects*

"Architects are conservative, for the reason that their art is the expression of the habits of the people whom they serve. The individual does not alter his mode of life from year to year"

The Composition of Stucco and Concrete

THE terms "plaster," "cement," "stucco" and "concrete" are so often confounded, even to the extent of employing them as synonyms, that it would be well to define these words in the sense they will be used in the pages to follow, and to explain the meaning of a few other words necessarily employed in a description of the uses of these materials in building construction.

Plaster is a mixture of sand, lime, hair and water, and is applied as an inside facing to the walls of a structure. Patent plasters of various compositions are manufactured to-day and, when mixed with water at the building, are ready for use.

Cement, that is to say, Portland cement (for natural cement and *puzzuolana* are not desirable in the preparation of stucco and concrete), is a finely pulverized product resulting from the calcination to incipient fusion of an intimate mixture of properly proportioned argillaceous and calcareous materials.

Almost all "standard" Portland cements, that is, brands which fulfill the requirements of the standard specification, are suitable for use in the construction of residences. The best brands are those which are of uniformly correct composition and that have slow-setting and quick-hardening properties. A good cement should develop initial set in not less than thirty minutes, but must develop hard set in not less than one hour, nor in more than ten hours. No time, therefore, should be lost, after adding water to the cement and aggregate, in placing the mixture in the forms. As an early removal of the forms is economical, and yet sufficient time is desired to place the concrete in the molds, the

advantage of a cement having slow initial and quick-hardening sets is obvious.

Stucco is a carefully proportioned mixture of Portland cement and sand (or pulverized stone) with the addition of water, applied as a covering to the unfinished outside wall of a structure, the construction of the wall being in stone, brick, tile, concrete or wood. Lime is often used as an ingredient of stucco to make it more plastic and so that the mixture will "work" more easily under the trowel. If ordinary quick-lime is used, however, its admission is more than likely to be for the purpose of effecting a saving in first cost. This is poor economy, for caustic lime as ordinarily prepared at the building site is a factor neither of strength nor of durability. If it is desired to use lime it should be hydrated.

Hydrated lime is, as its name implies, a compound formed by the union of lime and water. Fresh caustic lime is crushed and treated with just sufficient water to combine with it chemically, producing a dry powder. Care should be taken to add neither too little water to complete the chemical union and so permit particles of the lime to remain and "slake" at a later day, as a component part of the mortar, nor so great an amount as to produce a paste.

Stucco is often called a "sham" for the reason that it is popularly assumed to be an imitation of stone, but this is a false notion. Stucco in the past was invariably employed to cover some foreign surface of unsightly appearance, and as such performs a legitimate office.

Concrete is a mixture in known ratio of Portland cement, sand and broken stone, with the addition of water. Gravel, broken brick, marble chips or other similar material may be substituted for, or used in connection with, the broken stone. The mixture is poured into molds or forms, and hardens when the cement has "set," and, with the removal of the molds or forms, becomes a

Summer home of Dr. Benjamin Tenney, Manchester, Mass. *Dwight & Chandler, architects*

"The Fold," Summer home of C. R. and Ella Condie Lamb, Cresskill, N. J.

"Stucco applied to a wood skeleton is neither a false form of building nor an imitation, but merely a humble device invented by the forefathers of the Man of Moderate Means to keep out the elements by plastering their huts of reeds with a coating of mud"

Residence of Herbert E. Davis, architect, Glen Ridge, N. J.

"Stucco when properly made and applied is durable, inexpensive to maintain, a warm covering in winter, a cool one in summer, and is pleasing to the eye"

monolithic mass (known as plain or massive concrete) constituting the wall of the structure, whose exterior surface may then be scrubbed, hammered, picked, stuccoed or treated in various ways to provide a pleasing finish.

The materials used in concrete should be carefully selected, clean and proportioned in a manner to secure as nearly as possible a maximum density. A " dense " concrete is one which contains no voids, the " voids " being the air spaces between the particles of cement and the aggregate (the sand, gravel and stone used with the cement to give body to the concrete). The belief that so-called waterproofing compounds, as an ingredient of concrete, or so-called waterproofing paints applied to the outer surface of the wall, are necessary to make concrete proof against the percolation of moisture, is erroneous. A dense concrete is waterproof and requires no foreign matter in its composition nor any surface application to make it so. The strongest and most dense, and consequently watertight, concrete is made by selecting an aggregate which contains the least voids. The proper proportioning of concrete hinges upon the amount of voids in the sand, gravel and stone. A mass of aggregates of uniform size contains a greater percentage of voids than a mass of mixed sizes. The smallest percentage of voids is obtained when the mixture of aggregates is so graded that the voids of each size are filled with the largest particles that will enter them.

The aggregate, as explained above, is the material which, used in conjunction with cement and water, produces stucco or concrete. Fine aggregate consists of sand, crushed stone, or gravel, that will pass a screen having holes one-fourth inch in diameter, while coarse aggregate consists of gravel and broken stone which is retained on such a screen. The maximum size of coarse aggregate should not as a rule be greater than will pass through a three-inch ring. Hard, clean cinders, free from coal and ashes, make a suitable aggregate for light loads and for fire-

proofing. Cinders should not be used, however, in reinforced concrete.

Clean sand or gravel, free from loam or other organic matter, and clean water, are essential in the making of stucco and concrete that is durable and free from discoloration. These provisions are very important. If any of the ingredients of stucco or concrete contains foreign matter, and it is allowed to remain, it not only prevents the cement from forming a bond and becoming properly set, but it causes discolorations that are generally impossible to remove. As a safeguard, the sand should be thoroughly washed in clean water before it is mixed with the cement. The quality of the sand used in the making of concrete is quite as important as the quality of the cement, yet where cement is a carefully standardized article, meeting requirements of fineness and strength, sand is generally accepted upon the qualification of its being " clean and sharp." Often, any granular substance passes muster as sand, yet failures in concrete work have been caused by unclean aggregate as often if not more often than by poor cement. All sand must be free from vegetable matter. Loam and other foreign material is almost invariably found in sand, and even in minute quantities such impurities will either prevent the cement from setting or retard the hardening of the concrete for too long a period. If the grains of sand are clean, the cement firmly binds them.

The author, who boasts of no more than ordinary strength, had occasion one time to convince an unscrupulous contractor that he was not using clean sand by kicking over a twelve-inch brick wall three feet high which had been laid for three days. The weakness of the wall was due to loam in the sand and to the failure to wet the bricks before laying them. A good test of cleanliness is to take up a handful of the sand and submerge it in a pail of water. If the water shows any discoloration and the sand takes on a muddy look, it contains loam or impurities

Residence of Dr. W. W. Gilchrist, St. Martins, Pa. *Edmund B. Gilchrist, architect*

"For a rough coat and pebble-dash finish, two coats will suffice, but the total thickness of the stucco should not be less than one inch"

Residence of Lawrence Buck, architect, Rogers Park, Chicago, Ill.

"Contrary to the generally accepted idea that vines induce dampness in the walls to which they cling, the foliage acts as a protection, shedding the water and breaking the force of a driving storm"

that should be removed by a thorough washing. Sand should also be coarse. Fine sand requires much more cement to give the same strength that coarse sand would give. A fine sand, free from organic matter, may be used if coarse sand is not available, but the cost of obtaining coarse sand will generally be no more than for the added amount of cement that fine sand will require to obtain concrete of equal strength. It will be found that a selection of coarse sand will often decrease the cost per cubic yard of the concrete, by reason of the smaller quantity of cement required, without injury to the strength of the mixture. An equivalent of coarse sand is found in the residue of iron ore after the pure iron has been extracted — called taelings. So sharp is this by-product of the ore that a proportion of one part cement to five parts taelings has been shown to be as strong as a one-to-three mixture of cement and sand. Concrete may be considered as a cement-and-sand mortar to which has been added a coarser ingredient such as gravel or stone. The quality of this material being equal, the strength and density of the concrete mass is dependent on the quality of the cement mortar, of which the major part is sand.

Great care should be exercised in the selection of the coarse aggregate. It should be washed in the same manner as sand, and as regards the size of the pebbles or stones, a mixture graded from small to large gives the best result, for by this means the spaces or voids between the stones or pebbles are reduced and a more compact concrete is obtained, requiring less cement and sand. A mixture in which all the spaces (called voids) between the stones or pebbles are filled with sand, and all the voids between the grains of sand are filled and surrounded with cement, is the strongest and most waterproof mixture. This condition is rarely realized and as a safeguard it is well to use a little more cement than will just fill the voids.

The amount of each of the materials to use is determined

by the kind of work to be done. In the walls and floors of residences a mixture is generally used in which there is twice as much stone as sand, and twice as much sand as cement. The proportions should always be measured by volume, with the cement as the unit.

For reinforced concrete a proportion of one part cement, two parts fine aggregate and four parts coarse aggregate, is generally employed. For plain concrete, less cement may be used, depending upon local conditions and experience. The materials should be thoroughly mixed and be of a wet consistency, the amount of water being contingent upon the proposed use of the mixture. There are no set rules in proportioning concrete. A decision may be made only after examining and testing the materials to be used.

A very wet mixture, where the concrete runs off the shovel or trowel, is used for thin walls and floors, or for thin castings. A medium wet mixture, used for walls and floors, should be of a jellylike composition such that a man would sink ankle-deep were he to step upon a mass of it. About half an hour after mixing these materials the mass begins to stiffen; in less than a day it cannot be dented with the hand; and within a month it becomes hard as stone, indeed harder than most stones.

Maximum density, which gives to concrete the greatest strength and resistance to water percolation, is largely achieved by a thorough mixing of the ingredients. Concrete should be handled rapidly and in as small masses as is practicable and under no circumstances should it be disturbed after partial setting, or "retempered," that is, mixed with water after once the cement has begun to set. Before placing the concrete, care should be taken to see that the forms are substantial and thoroughly wetted or oiled to keep the concrete from adhering when they are removed, and that the space to be occupied by the concrete is freed of all rubbish.

When concrete is to be subjected to a tensile stress it is formed around iron or steel rods, and is then known as reinforced concrete. It is variously known as ferro-concrete, armored-concrete and concrete-steel. The last three terms are objectionable, however, upon the ground that they are both inexact and misleading. "Reinforced concrete" pleads guilty only to the sin of omission. As soon as we understand that the reinforcement is iron or steel, reinforced concrete becomes an acceptable name for this wonderful material.

A treatise upon the structural design of reinforced concrete would probably be too technical for the average reader of a book of this character and scope, and therefore no theory of design relating to the analysis of beams, columns, stresses and strains will be attempted. It is sufficient to say that calculations should be made by an experienced and qualified engineer, to determine the sizes and manner of distribution of the steel reinforcement, as well as the spacing of beams, girders and columns, and to specify all necessary structural requirements for the insurance of stability, durability and the economic designing and handling of the materials employed.

The successful execution of any work in which the materials described are employed requires the best of labor and material. This does not mean that construction in stucco and concrete is necessarily expensive. Some or all of the necessary ingredients may be found on or near the site of the structure to be erected, or they may be purchased in nearby markets for a reasonable sum. Labor too may be cheaper and more readily obtained in one locality than in another, although the scarcity of good artisans in these times is an undisputed fact and is one of the direct causes of the high cost of building and of the poor workmanship we are often obliged to accept.

We are in greater need of good artisans than the product of any other curriculum. Of what use are beautiful drawings and

carefully prepared specifications and minute and accurate instructions, if no artisans with sufficient skill and understanding can be found to execute the work in accordance with these provisions? Economic and artistic building in America is suffering to-day from a scarcity of teachers who can teach, from a paucity of trade schools and from the baneful influence of *the current methods* employed in trade unionism. The palatial housing of students and professors, which is now the fashion, is accomplished at the expense of learning. Were some of the millions of dollars with which our schools and colleges are endowed, and at once translated into stone monuments, used to attract, by means of adequate salaries, to their chairs of learning, men of special talent for implanting useful knowledge in the minds of the young, the next generation would have better heads and hands to carry out the tasks that will confront them. A man may be learned and yet unable to implant knowledge in the mind of another. A good teacher, like a good sponge, should be capable of absorbing and squeezing out with equal readiness. It is preposterous to assume that a man of such talents will accept the beggarly wage customarily offered to him.

We need additional trade schools far more than additional libraries, with experienced teachers for the youth whose condition in life is such that his time and his money are limited. The " unions " often restrict the opportunities of a bright, industrious boy in the learning of a trade and throw serious obstacles in the way of his advancement. He is often denied the right and privilege to learn a certain trade because the number of apprentices is arbitrarily limited, thus creating an artificial value by restricting the supply. Even if he is lucky enough to be apprenticed or can attend a trade school, and finally becomes a journeyman, the faithful, hard-working and ambitious mechanic is forbidden to use his hands as fast as he might, and as long as he would, and by printed rule compelled to work side by side with his lazy and

The Rutherfurd house, Cedarhurst, L. I. *Louis Boynton, architect*

"Trellis-work is a valuable adjunct to stucco in concentrating the eye about some salient feature such as an archway"

House at Sewickley Heights, Pa. — *Janssen & Abbott, architects*

"Wrought iron is especially suited to the decoration of concrete surfaces"

incompetent brother at the same wage. Is it any wonder that under these stifling and depressing conditions a man fails to develop his talents to the full?

In general, skilled artisans are necessary to obtain thorough and lasting results, as well as an artistic rendering in stucco and concrete. Unskilled labor is used, of course, in the delivery, handling and mixing of the various materials employed, but these worthies must always be under the watchful eyes of skilled mechanics and foremen if a creditable piece of work is to be achieved.

Stucco as an Outside Wall Covering

THE history of architecture shows us very clearly that the housing of man has with few exceptions been accomplished with the materials nearest to hand. Occasionally a conquering nation has acquired in part the fashions of the conquered and has builded upon the spoils of war. Again, in the discovery and colonization of new lands, the settlers have imported the products of the mother country with which they were familiar. But with the wider circulation of knowledge since the advent of steam power, the printing press, the photographic camera and the harnessing of electricity, the limitations that generally confined our ancestors to the selection of home-made building material have been largely removed, and the desire of the reader and the globe-trotter to adapt such ideas as have appealed to him in his books and travels, has been gratified by the means given him through the rapid advance of civilization, while his less active neighbor has contented himself with a slavish or modified copy of such novelties as have cropped up about him. This process of architectural evolution is most apparent in the modern structures to be found in America, and the heterogeneous types erected here in the last twenty-five years are characteristic of the conglomerate race that forms its population and of the avidity with which the novel inventions of recent years have been seized and employed in the construction of the American home.

The choice, therefore, of the nearest available material is no longer a specified requirement because of that qualification. Common sense should dictate a durable form of construction, and good taste will suggest an outward appearance that will be in harmony with the character of the land. Among the durable

"An occasional crack, if it is not too large or due to a structural defect, is not a serious blemish"

Two views of a garage at Bristol, R. I. — *Kilham & Hopkins, architects*

"In fact a flawless one-toned wall is apt to be painfully monotonous and must be partly covered with vines before it can lay claim to any beauty"

House at Sewickley Heights, Pa. *Janssen & Abbott, architects*

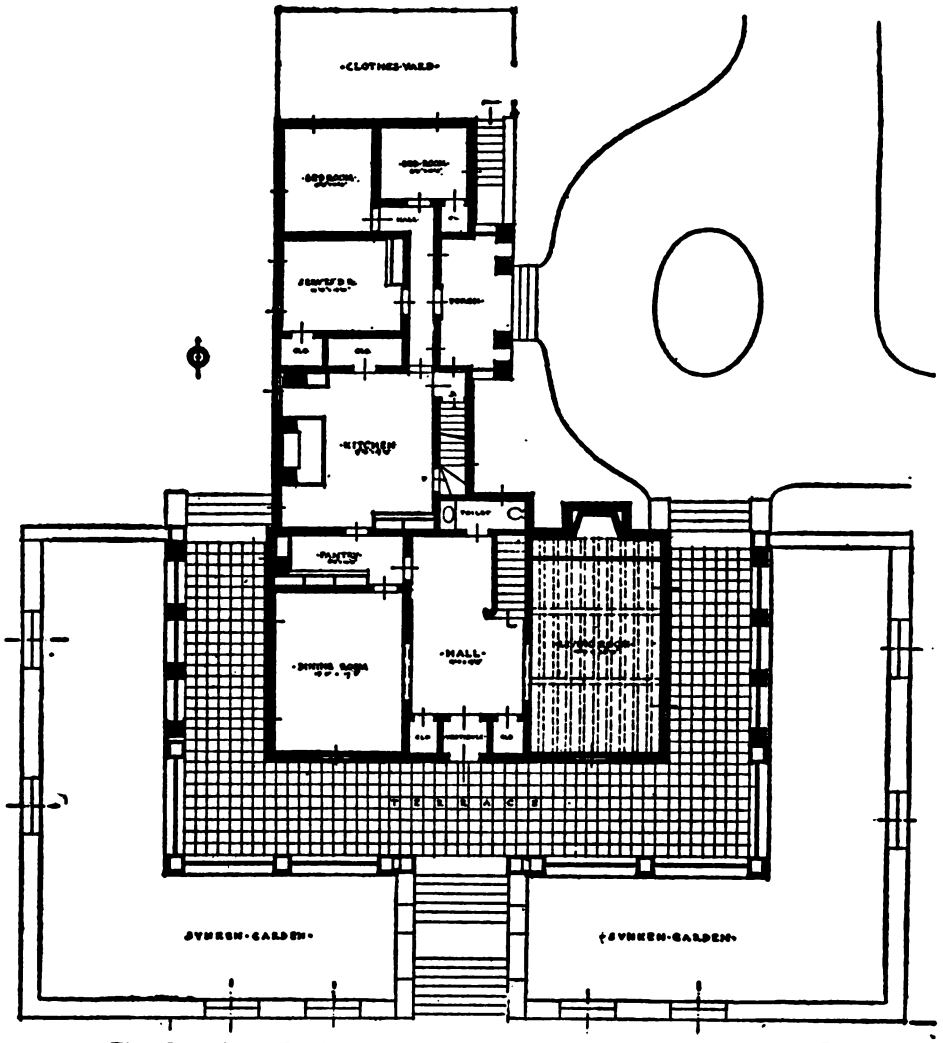
"It is not necessary for the surface of stucco to be even in tone, provided the variation in color is agreeable and not caused by the use of unclean material"

materials available for building purposes are stone, brick, concrete and various substantial products such as terra cotta tile and steel, that require a veneer of masonry, concrete or stucco. Fascinating as the old wooden houses of New England are, they are not in sympathy with the present-day civilization. To expend such thought and care, energy and money, upon a structure that begins to deteriorate the day it is begun, that involves continual care and expense to retard its decay, and that may vanish over night in smoke and flame; to build a temporary structure in which posterity has no interest, when a durable and lasting monument of equal beauty may as readily be had, would indicate that sentiment had overcome good judgment. Wooden buildings cannot keep pace with the march of progress, and it indicates no lack of respect for these one-time giants of Colonial architecture to suggest that their propagation cease.

The day of wood for the exterior covering of an all-year-round house has gone by, and stucco has largely taken its place. Curiously enough, stucco lends itself with extraordinary readiness to almost any architectural design that may be suited to the particular environment. That the lay of the land, and the needs and characteristics of the inhabitants determine the style of architecture to be employed is an undisputed fact, but it is no exaggeration to say that there are few if any instances in the suburban and country communities of America where sand and gravel prevail, that stucco and concrete cannot be fittingly employed to express the true spirit of the neighborhood.

While a frame building is to be condemned upon the ground that it is at best a flimsy and transitory structure, a man should not cut off his nose to spite his face. The cry of "fake" and "sham" is periodically raised by the starving purist and the millionaire iconoclast at this form of construction. As a matter of fact, stucco applied to a wood skeleton is neither a false form of building nor an imitation, but merely a humble device in-

vented by the forefathers of the Man of Moderate Means, to keep out the "elements" by plastering their huts of reeds and



First floor plan, villa of Mrs. Robert Stafford, Lloyd's Neck, Huntington, L. I.
Lionel Moses II, architect

rough-hewn timbers with a coating of mud. Later it was used to cover masonry that presented an unsightly surface.

Until a more durable building material is available at the

Villa of Mrs. Robert Stafford, Lloyd's Neck, Huntington, L. I. *Lionel Moses, II, architect*

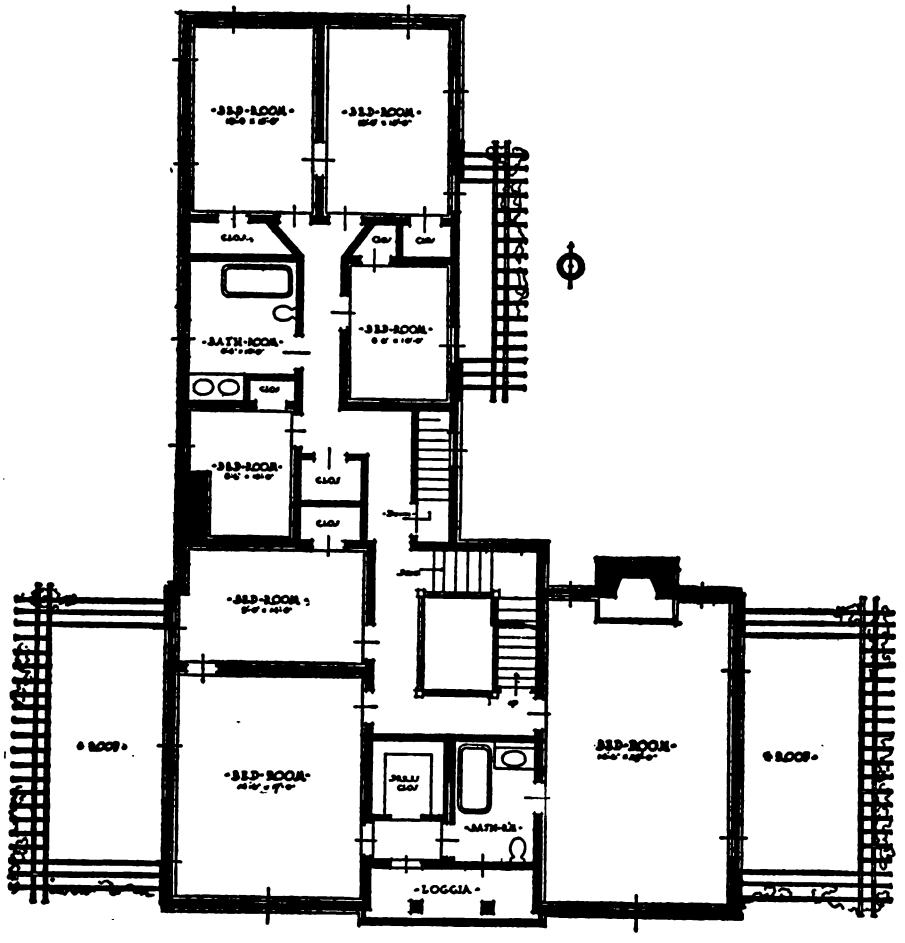
"The stuccoed frame house is a popular and quite prevalent form of construction"

"It is cheaper than solid concrete or masonry construction, and a stucco covering is more durable and less costly to maintain than a covering of shingles or clapboards"

House on York Road near Philadelphia, Pa.

"Dame Nature took a hand and . . . a sparkling and mottled yellow, white and gray effect has been obtained that never would have been possible in a one-tone mixture or with paint alone"

same cost, we must reconcile ourselves to the fact that as the average American is here to-day and there to-morrow, he will not invest more than he is compelled to for things whose sole virtue



Second floor plan, villa of Mrs. Robert Stafford, Lloyd's Neck, Huntington, L. I.
Lionel Moses II, architect.

is durability and permanency. It is an unfortunate situation, but the fact cannot be dodged. The cost of wood, however, is steadily increasing, and in view of the wretched quality now being served out at a price that ten years ago would buy the best,

many minds have turned in search of new and better material to take its place at the same price. Unless all signs fail, Mother Necessity will soon receive a visit from the Stork, with a timely bundle of cement products at popular prices.

The poor quality and costliness of wood, and its steady decay, have not been the only factors in spurring men on to search for a better structural material. The horrors and losses due to fire have shocked and roused them into activity, and the promised advent of an unburnable house at moderate cost is cause for sincere rejoicing. The fact that his house will stay put for centuries does not interest the American as keenly as does the assurance that it will not disappear over night with all his treasures, animate and inanimate. Incidentally he is pleased to learn that the cost of maintenance and insurance will be reduced to a minimum.

As for the style of architecture that will prevail, only time will decide. Stucco and concrete adapt themselves to any form of plastic design, and manufactured stone to articulated design, and each lends itself readily to modifications of almost every style that could be conceived as suitable in respect to our national inheritance. We are mainly a mixture of the Anglo-Saxon, Germanic, Gallic and Romanic races, and our houses may properly reflect a suggestion of English, German, French and Italian styles past and present, all of which are readily expressed in terms of stucco, concrete and manufactured stone.

Stucco was used in this country extensively in Colonial days, chiefly by the Dutch settlers in New York and the Germans in Pennsylvania. It generally provided a covering for rubble walls, the stone laid in what was little better than clay mud. Cement at that time was unknown, and lime an expensive imported material. These crudely built walls soon began to deteriorate from rain and frost, and to protect them an application of stucco was made, composed of sand and shell lime. This

mixture did not resist the repeated attacks of water and cold any too well and therefore was itself partially protected by wide overhanging eaves, giving birth to the well-known "Germantown hood" and the projecting roof lines of the Dutch Colonial style.

Stucco has a great deal to recommend it in house construction, but it has also some conspicuous drawbacks. Stucco is much like the little girl who, "when she was good she was very, very good, but when she was bad she was horrid." When properly made and applied it is durable, inexpensive to maintain, a warm covering in winter and a cool one in summer, pleasing to the eye and susceptible of an unlimited number of variations in texture and color. When badly or carelessly made and applied, no material could be worse, for if it does not fall off entirely it will peel off in sections, bulge, crack, absorb water, spot, streak and take on either a dull cheerless gray or a medley of tints, as the ill-chosen mixture or poor workmanship may determine. Its so-called defects are usually traced to the ignorance or carelessness of the men who specify and handle it, if not to a deliberate swindle.

From an artistic standpoint, perfect uniformity of shade in stucco is not essential or even desirable. A certain amount of blending variation in tone is pleasing to the eye, while a perfectly even color lacks character. Of course an abrupt line of demarcation such as would be produced by a radical change in the mixture, or in the difference in workmanship of one man and another, or from a change in the weather during the operation, is not always desired. But one thing should not be lost sight of: a completed stucco house looks its worst at the moment of completion. It continues to improve in appearance with age.

If stucco of a decided color is desired, only mineral colors should be employed, and these had better be used sparingly and

limited to carbon black, ochre and red oxides of iron and their combinations. It should be borne in mind that coloring matter reduces the strength of the stucco. Very pleasing shades may be obtained, however, without the use of pigments; such, for instance, as grayish white, pure white and light buff. The first is secured by mixing crushed white quartz with ordinary gray cement, the second by marble dust with white cement, and the third by yellow sand or gravel with white cement. If pigments are used they should be mixed dry with the sand or gravel and then with the cement. A uniform mixture cannot be obtained if any of the ingredients are wet. Mixing in paste form is sure to distribute the color unevenly, and the trowel striking a lump of color will produce a spot or streak. By mixing the ingredients dry, a sufficient amount for the entire operation may be obtained and kept until needed, pure water being added to such quantities as may be immediately required. This method prevents the unevenness in color that generally occurs when "batches" are mixed at different times. Smooth surfaces that are "floated" or troweled rarely show a perfectly even color, no matter how accurately the ingredients are proportioned nor how carefully they are mixed. No two men trowel alike, nor can one man continually preserve the same degree of pressure; consequently different surface textures occur from the varying amounts of cement or fine material that come to the surface, producing a difference in shade or color. Freezing will also change the color of stucco, as will sunlight, a dry wind, or cloudy and rainy weather. A moist, cloudy day is the best for a good stucco finish, and where it is exposed to sun or wind the stucco should be covered with damp cloths hung to protect it, and invariably the whole of one unit of space should be completed in the operation.

Lime stucco has been used extensively in the past, both for protection and ornamentation. It reached a high state of devel-

Residence of Witherbee Black, Esq., Pelham Manor, N. Y. *Oswald C. Hering, architect*

"The day of wood for the exterior covering of an all-year-round house has gone by and stucco has largely taken its place"

Residence of Murray Guggenheim, Esq., Elberon, N. J. *Carrère & Hastings, architects*

"Architecture which expresses the function of the object, which exhibits a logical use of the material used and offers a pleasing proportion of light and shade, is good architecture"

opment with the Persians, Greeks and Romans, and later with the Moors. On this continent we find mud stucco in the adobe huts of Mexico, lime stucco in the Mission houses of California, coral stucco in Florida and Bermuda, and a stuccoed rubble stone in New York and Pennsylvania. But until the advent of Portland cement, stucco was unable to withstand the ravages of time except in countries where the climate is warm and dry. Cement stucco grows harder with age and is not affected by the weather conditions that prevail in the temperate zone, after once it has hardened. In a climate such as we have above Mason and Dixon's line the admixture of ordinary lime in stucco is not advisable. It cheapens the first coat and makes it flow more easily and in quicker time from the mason's trowel, and for these reasons is often used in place of an adequate proportion of cement. It is difficult to prepare and to mix thoroughly the lime paste with the cement and sand, and particles of unslaked lime are apt to enter the mixture to its detriment. Hydrated lime — a lump lime slaked by a mechanical process, in which the water is driven off, leaving an impalpable powder — overcomes this objection, but as hydrated lime is practically as expensive as Portland cement, its use serves little purpose other than to lighten the color of the stucco and to " fatten " the mixture and so make it work more easily under the float.

Stucco should never be applied in freezing weather. If the water freezes before the cement has set, the stucco will not harden. Nor should stucco ever be disturbed before the cement has set, otherwise it will not adhere to the surface to which it is applied. While a frame building covered with stucco is in no sense fireproof, such a covering does act as a fire retard. Stuccoing should always be started at the top of the building and the work carried downward to some projecting member or recess. If it is impossible to complete an entire wall during one operation, the work should be halted at some division line, such as a band,

window or door. If three coats are applied, the surface of the first and second coats should be deeply scratched while they are wet, and three coats are desirable if the finish is to be smooth. For a rough coat and pebble-dash finish, two coats will suffice, but the total thickness of the stucco should not be less than one inch.

A smooth finish is secured by bringing the final coat to an even surface with a wood float; under no circumstances should a steel trowel be used for this purpose. Rough-cast and pebble-dash finishes are obtained by applying gravel or pebbles, mixed with cement and water, dashed on with a paddle or whisk-broom after wetting down the under surface. This gives a very pleasing texture and a variation in tones that overcomes the monotony of a perfectly smooth and uniform surface.

One of the most interesting and attractive of the various surface treatments employed by the author is what is termed the "dry dash." The "scratch" coat is applied in the usual manner and while still wet, aggregates, selected for their size and color, are dashed upon and partly embedded in the soft background.

The "personal equation" cuts a large figure in stucco work. Few men in this country have either the knowledge or the "knack" of applying stucco in a manner that will be both durable and pleasing in appearance. The obstinate adherence of the average workman to his own notions, and the opinion he entertains that the specification prescribed by the architect is of no great importance, operates strongly against one's best endeavor. The author has made it a rule to impress upon the owner the importance of employing the most skillful men who appreciate the importance of a strict observance of the precepts respecting the method and mixture required to produce the desired effect. It should be borne in mind that stucco is subject to the action of the weather, including heat, cold, moisture and aridity, to shrinkage, settlement and all the ills that the exterior

"Wooden buildings cannot keep pace with the march of progress, and it indicates no lack of respect for these one-time giants of Colonial architecture to suggest that their propagation cease"

Two views, residence of H. E. Huntington, Esq., Los Robles Ranch, Cal. *Myron Hunt & Elmer Grey, architects*

"Stucco and concrete adapt themselves to any plastic form of design and lend themselves readily to modifications of almost every style that could be conceived as in any respect suited to our National inheritance"

Residence of Louis Dejonge, Esq., New Brighton, S. I. *Delano & Aldrich, architects*

"A completed stucco house looks its worst at the moment of completion. It continues to improve in appearance with age, and should never fail to have its complement of vines"

walls of a building are heir to. Many stucco houses present a sorry appearance by reason of ignorance or neglect on the part of the owner, architect or contractor. The most careful inspection and supervision of the architect avail little if the "lowest bidder" attempts to skimp the work by the employment of unskilled masons and poor material. The architect can cause a halt in the work, but this often results in an endless dispute, and as time is often a factor and a lawsuit always a nightmare, the best of a bad situation is frequently accepted.

From this reference to the contractor it must not be assumed that he is, as a class, dishonest and tricky. The author enjoys the acquaintance of many builders who are not only honest and capable but who take such pride in their work that they will not tolerate any deviation from first-class building methods. The honest and capable contractor labors, however, under a great disadvantage when subjected to the pernicious custom of awarding the work to the "lowest bidder." The owner's unquenchable thirst for the "lowest bid" invites reckless estimating and if the successful bidder finds later that he has figured the cost too low, the temptation is great to make good his loss by skimping the work.

The fine hair-cracks that frequently appear upon the finished surfaces of stucco, called crazing, are generally due to the too rapid evaporation of the water, before the cement has had time to set. These cracks may be largely avoided by stuccoing on a damp, cloudy day, when there is little or no wind, or by protecting the stucco from sunshine and breeze by screens or other device. An occasional crack, if it is not too large or due to a structural defect, is not a serious blemish. In fact a flawless one-toned wall is apt to be painfully monotonous and must be partly covered with vines before it can lay claim to any beauty.

Vines are as essential a covering to outside walls of masonry and stucco as draperies and pictures are to the inside plastered

walls of the room. They relieve the monotony of an expanse of wall and soften its rigid lines. Contrary to the generally accepted idea that vines induce dampness in the walls to which they cling, the foliage acts as a protection, shedding the water and breaking the force of a driving storm. A stucco wall, or a surface of brick or stone for that matter, rarely becomes a part of the landscape until it receives a dress of creeping and clinging foliage. It is a lamentable fact that many a fine house remains for years *in statu quo,* cold and forbidding, a monument to the owner's ignorance or laziness with respect to this finishing touch. Still more often, a wall poor in color or texture stands for years a source of woe to the owner, and a target of criticism for the passer-by, whereas a few vines creeping over its unsightly face would probably transform those very defects into a general mass of beauty.

The decorative possibilities of stucco are almost unlimited. It may be used as a unit covering tinted in various colors; combined with " half-timbers," it provides a striking contrast to these wooden members in color and texture; and when used in connection with wire-cut brick an infinite variety of schemes are made possible, each material acting as a foil to the other. The parge work of England is an example of modeled stucco ornamentation that might readily be adapted to American needs, and Italian *sgraffito* could be used to advantage in relieving the monotony of a single-toned surface. Stenciling with colored cement washes is an interesting way of treating a smooth stucco surface, but this method of decoration is more usually confined to porches, loggias and portions protected from the action of the weather, for the range of coloring matter includes none of any great permanence when exposed to the elements. As to the use of color, it may be said that owing to the lack of experience or courage on the part of the architect, or due to the veto of the owner, very few examples are to be seen that excite favorable

Residence of Louis Dejonge, Esq., New Brighton, S. I. *Delano & Aldrich, architects*

"Lattice-work serves the purpose of a support for vines, and until these become sturdy in growth, affords an effective and inexpensive form of decoration"

Residence of Gage E. Tarbell, Esq., Garden City, L. I. *Oswald C. Hering, architect*

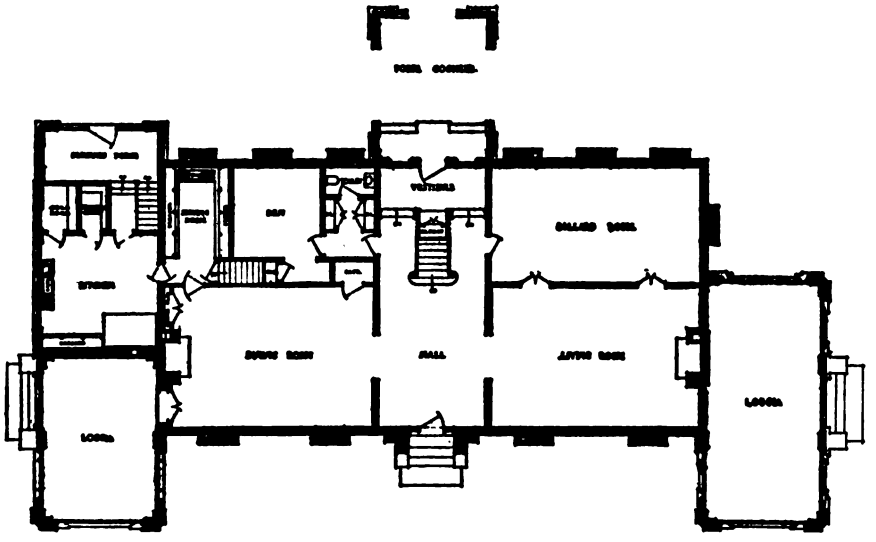
"The loggia is gradually supplanting the columned porch in popularity because of the readiness with which it can be screened in summer and glazed and heated in winter"

mention. When the work is exposed, the mistake is invariably made of selecting such shades and tones as are effective at the moment, forgetful that the ravages of time, the action of the sun, wind and water conspire to bleach, and the dust to blacken, the chaste tones so fondly conceived. More daring is required of the architect and more confidence of the owner. Time should be discounted, even at the expense of a year's nervousness over a glaring chromatic display. "Painfully new" is an expression that applies to buildings as well as to footwear. As it takes a few days' usage to remove the distracting qualities of a new pair of boots, so the passage of a year or two is generally necessary before a newly built house blends happily with the surrounding landscape.

It is not necessary for the finished surface of concrete or stucco to be spotless and even in tone, provided the variation in color is agreeable and not caused by the use of unclean material. The softening tones which age will give to the stucco improve its appearance, and consequently there are many instances where an unevenness in color of the stucco upon the completion of the work need occasion no quarrel with the contractor. The conception of the architect should determine whether or not the appearance is such as will contribute to or detract from the completed picture a few years hence.

Stucco on Wood Frame

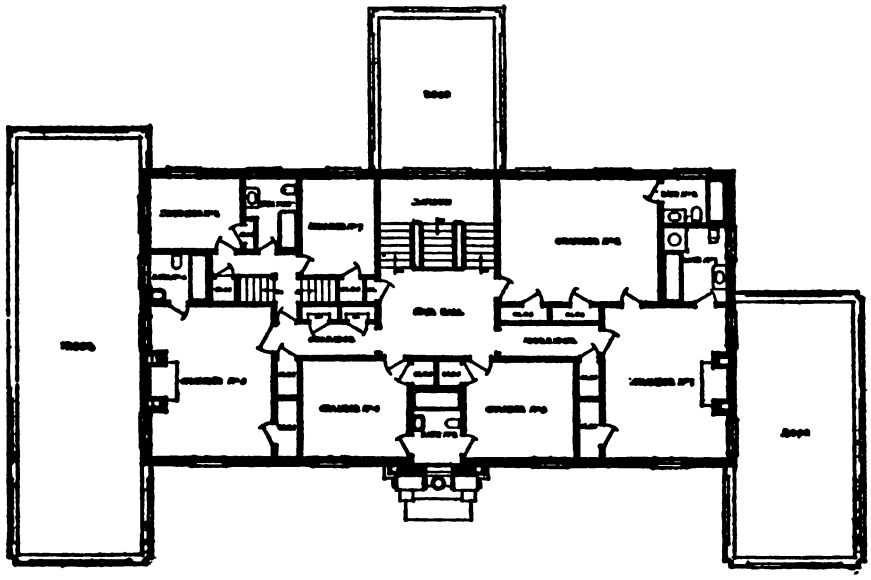
IN the environs of most of our eastern cities the usual mode of construction employed in suburban and country houses is a wood frame composed of upright and horizontal members tied together and braced, the exterior walls being then covered with shingles or clapboards, and the interior wall surfaces plas-



First floor plan, residence of Gage E. Tarbell, Esq., Garden City, L. I.
Oswald C. Hering, architect

tered. A house of this character is not well insulated against heat and cold and is rarely weather-tight. It is highly inflammable and subject to more or less rapid deterioration, depending upon the quality of the labor and material employed and the prevalent climatic conditions. Of course, all shingle and clapboard houses do not come under this category. The writer has lived in frame houses that were built over a century ago, but

that was a time when they builded well and employed material and methods of construction the cost of which to-day would be prohibitive. Heavy beams of oak and pine, mortised with tusk and tenon, are to-day supplanted by slender spruce and hemlock joists notched and spiked. With the employment of good methods of framing, however, and the space between the studs of the outside walls " back-plastered " before lathing and plaster-



Second floor plan, residence of Gage E. Tarbell, Esq., Garden City, L. I.
Oswald C. Hering, architect

ing the inside surfaces, and the outside covered with ship-lap sheathing, then with heavy building paper, and finally with good, seasoned shingles or clapboards, a fairly durable house may be built; and if the shingles are left to acquire their color by the action of the weather the " up-keep " is reduced to a minimum. For a wood exterior, the life of a " weathered " shingle is approximately ten years on the roof and twenty on the wall. If clapboards are used for an outside covering of the frame skeleton, the initial cost is generally raised by the necessity of paint-

ing these boards, and the cost of maintenance is similarly raised by the requirement of additional coats of paint every three or four years. Timber, too, is becoming scarcer and consequently dearer, and lumber that is "clear" and free from defects is in many instances so rare and costly as to prohibit its use in houses of moderate cost.

Excepting in certain localities and under certain conditions, concrete and stucco are, as yet, more expensive forms of construction and finish than wood, but the margin of difference is slowly but surely decreasing, and there seems to be no doubt that within a few years wood for structural members, and for an exterior covering of walls, such as shingles and clapboards, will be generally abandoned in favor of the more durable materials with which these chapters treat. An intermediate stage of this slow evolution, where cost is a factor but not so great a one as to require the use of either shingles or clapboards for an exterior covering, is the "stuccoed frame" house — the house constructed of wood, but given an outside covering of stucco. Houses of this character have all the appearance of concrete and are often mistaken for this construction, as well as fraudulently advertised as such. The stuccoed frame house, nevertheless, is a popular and quite prevalent form of construction. It is cheaper than solid concrete or masonry construction, and a stucco covering is more durable and less costly to maintain than a covering of shingles and clapboards. Furthermore, it adapts itself with wonderful readiness to almost all the prevalent styles in domestic architecture.

A situation may therefore arise — in fact it does frequently arise — where the environment demands a structure of concrete, or of stuccoed masonry, while the owner's pocketbook contains only enough to pay for building a skeleton of wood, with sufficient left over for a covering of either shingles or stucco. Most people would agree that a man who would take more than half

Residence of A. H. Marks, Esq., Marblehead, Mass. *Andrews, Jacques & Rantoul, architects*

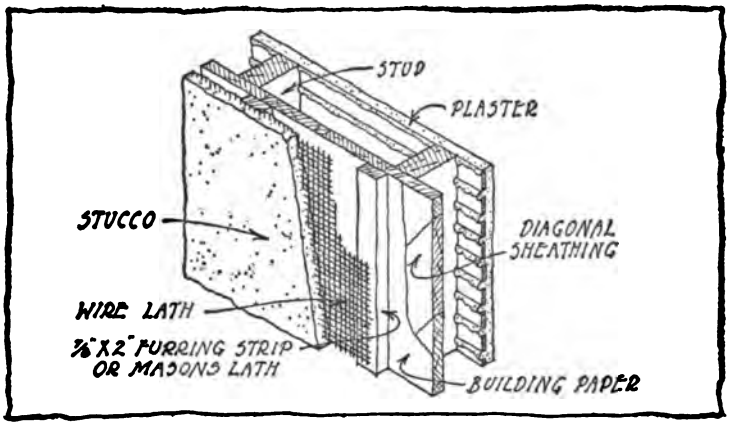
"Few men in this country have either the knowledge or the 'knack' of applying stucco in a manner that will be both durable and pleasing in appearance"

Residence of A. H. Marks, Esq., Marblehead, Mass.

Andrews, Jacques & Rantoul, architects

"A smooth finish is secured by bringing the final coat to an even surface with a wooden float. Under no circumstances should a steel trowel be used for this purpose"

a minute to decide between these two coverings is too good for this world, both for the reasons given above and those to follow. *Stucco, when properly applied to a frame building, will last as long as the framework behind it.* It will not require a dollar to be spent in maintenance, and it will improve in strength and appearance with age, always bearing in mind that it must consist of the right ingredients, skillfully mixed and properly put on.



Stucco on wire cloth over furring strips on the ordinary wood frame building

There are several methods employed in stuccoing a frame building that give a fair assurance of the lasting qualities desired. In any case, however, the wooden uprights or studs should be diagonally (not horizontally) sheathed, to give additional rigidity to the framework, and then covered with sheathing paper of the best quality. Right here it should be noted that one of the worst "economies" and greatest extravagances employed on a frame building is the use of a cheap and flimsy building paper as a covering to the sheathing, upon which the shingle, clapboard or other outside finish is next applied. A tough and closely woven building paper, by giving a more effective insulation against heat and cold than would be possible with a cheaper paper, will probably save in the coal bills of a season more than

enough to pay the difference in cost, and will insure a more comfortable house both in winter and summer.

After the sheathing paper has been applied, the wall is then prepared to receive the stucco. It is the author's opinion, however, that only four such methods of preparing the wall deserve serious consideration, and that others now practiced are but temporary makeshifts which sooner or later are bound to involve the owner in more or less trouble and expense.

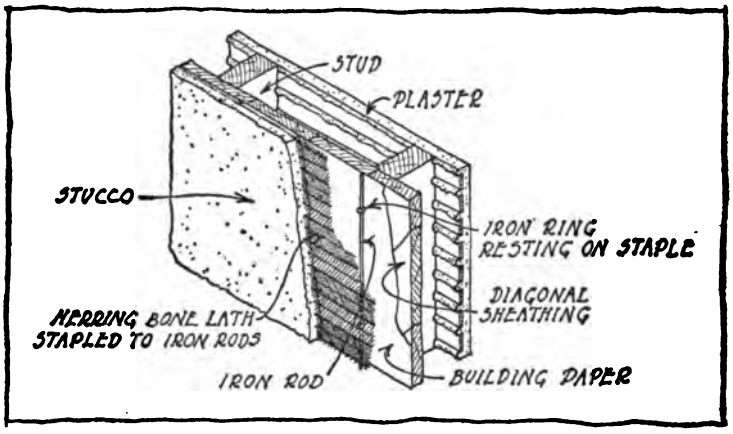
The least desirable of the four methods is the following: To the sheathing, which has been well covered with building paper, are nailed wood furring strips seven-eighths of an inch thick and two inches wide, set vertically and spaced about ten inches apart. To these strips a galvanized iron lath of "herring-bone" pattern, or of three-eighths of an inch mesh, stiffened with round or V-shaped rods, is tightly stretched and firmly stapled.

There are at least four objections, however, to this method of preparing the wood framework of the building to receive and hold stucco. The shrinking and swelling of the wood strips from atmospheric changes are very apt to cause the stucco to crack on the face of these wood strips, and while fine hair cracks need cause no serious alarm and may soon be covered from view with vines, a space of a sixteenth of an inch or more is apt to admit moisture and frost with possible serious consequences.

A second objection is the uncertainty of completely covering the inner side of the metal lath with the stucco, necessarily applied from the outside, and unless the inside face of the metal is completely embedded in the stucco, oxidation is bound to ensue, and within a few years the iron will be completely destroyed. The writer has many times observed this condition when, in altering and adding to existing buildings stuccoed in this manner, it became necessary to cut through and remove portions of the old stucco. Scarcely anything remained of the metal

mesh beyond its pattern in rust, and the stucco was merely held in place by its own weight. It had not become dislodged because the building had never been sufficiently jarred by wind, quake or other disturbance.

Third, in order to obtain a good clinch upon the wire mesh and to enable the mason to apply the stucco with ease and dispatch, a certain proportion of lime often forms an ingredient of the first application, or " scratch coat," of the stucco, and this



Stucco on a herring-bone type of metal lath stapled to iron rods to offset the disadvantage of wood furring strips

introduces an element of weakness that is responsible for more defective and generally unsatisfactory stucco work than any other factor. In moist and rainy weather the lime absorbs water, softens and finally disintegrates, while cement hardens under the same conditions. The harder the stucco the longer it will last and the better protection it will afford the framework it covers. The introduction of lime diminishes the strength of the mixture and so invites a more ready entrance of water and frost, which may seriously impair the walls. To these objections might finally be added the waste and consequent expense due to the considerable amount of stucco that falls down between the mesh and the sheathing during the operation of stuccoing.

A better method, and the second of the four to be described, is to use ordinary builder's lath instead of the thicker furring strip. The chances are that, in applying the stucco to the wire mesh fastened in this manner, the inside face of the mesh will be more completely imbedded by reason of the resistance of the sheathing to the pressure exerted in applying the stucco. As none will be lost, less stucco will be required, the space between the metal lath and the sheathing being filled solid with the mortar. The broad surface of the wood lath is still an objection, however, as it provides no clinch for the stucco across its surface and these wood strips will shrink and swell as the weather is dry or wet.

So we come to a third way of applying stucco to a frame building, which, in the author's experience, has advantages over the other two: the troweling of the stucco upon a dovetail-grooved composition board, seven-eighths of an inch thick, known as "stucco board," and which is nailed to the sheathing over a layer of heavy building paper. The manner of applying these composition boards (a stucco composition reinforced with wood fiber) and of treating them after they are put in place is of the greatest importance. Unless the directions are closely followed the finished product will be most unsatisfactory. The following specification has been used with success:

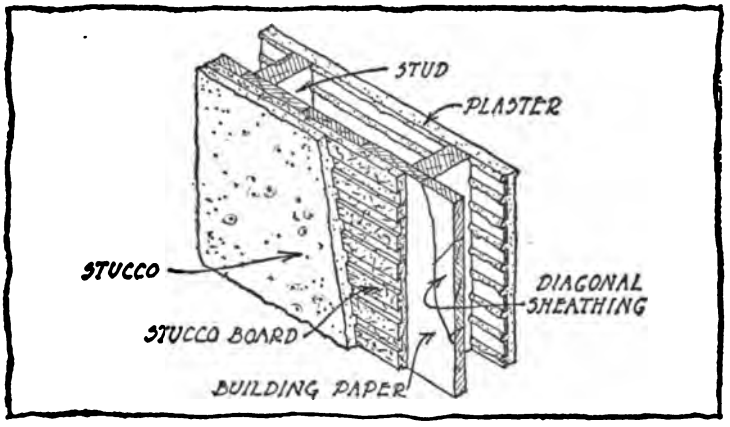
"Cover the sheathing of the outside frame walls with the stucco board, nailed thoroughly with large-headed, galvanized slater's nails, $1\frac{1}{8}$ in. long, using sixteen to twenty nails to each sheet.

"Sheets must be put on with keys running horizontally, breaking joints and leaving a space of $\frac{1}{2}$ in. between all edges. After wetting the edges these spaces should at once be filled in with the scratch-coat mixture. When ready to apply the first coat, thoroughly wet the entire surface of the plaster boards, using a hose.

"On this apply a first coat, composed of one part Portland cement and three parts of well-washed sand, adding some hair,

and forcing the mortar thoroughly into the keys of the board and over the joints between the sheets to a thickness of ½ in. from face of the board. When bone-dry apply a second coat ¼ in. thick, composed of one part cement and two parts clean coarse gravel, dashed on with a paddle. Bands and molded portions shall have a troweled finish."

The advantages of this method of supporting the stucco, in place of a wire or other metal mesh, are these: there is no metal



Stucco applied to stucco board which is nailed directly to the sheathing without the necessity for furring strips of any kind

to rust; there is no necessity for using lime in the scratch coat, as cement stucco will readily adhere to the stucco board; there is a minimum of waste and expense due to the fact that less stucco is required and none is lost in the application; and, finally, forming as it does, in conjunction with the stucco board, a homogeneous mass of nearly double the thickness of stucco as applied to a metal mesh, the chance of any penetration of moisture is reduced to a minimum. The author had occasion some years ago to complete an unfinished wing of a frame house stuccoed upon this composition board. It was necessary to cut into the stucco in several places, and wherever this was done there was no distinguishing, except in color, between the stucco and the com-

position board; both were practically amalgamated and as hard as granite.

At all corners of the walls of the building, or of the door and window reveals and in narrow widths, such as occur between the timbers of half-timbered construction, and in forming bands, cornices and other molded work, wire mesh should preferably be used, as it is obviously more pliable and more easily adjusted to curves and angles than the stucco board. In such instances the mesh should overlap and be well nailed to the adjoining stucco board, and the stucco firmly troweled to insure the complete imbedding of the mesh.

The author freely admits that he knows of architects and contractors who have employed this dovetail-grooved stucco board without success, and who condemn it in emphatic terms, but in every such instance which he has investigated, the trouble has readily been traced to the improper handling and treatment of the material employed.

Iron and steel lath will corrode unless protected from air and water, which, besides oxygen, may contain gases and acids that act upon these metals. Corrosion is also caused by electrolytic action produced by the contact of dissimilar metals, and from leakage in electric wiring systems. There are three more or less effective ways of protecting the metal lath. It may be painted, and so exclude both air and moisture, but the paint is apt to chip off or wear away in the handling of the lath, and these vulnerable spots offer points of attack. The lath may be galvanized, that is, covered with spelter or a coating of zinc, but this attempt to stave off disintegration is difficult if not impossible of achievement, for without a complete covering of the lath a portion of the surface, particularly at the edges, is likely to be left unprotected, and here the attack will begin and spread. Electrolysis, the sulphur-laden atmosphere of our inland cities, or the damp salt air of the seaboard, sooner or later destroys the

spelter, and for this reason thoroughly protected asphaltum-covered lath is preferable to galvanized lath. The difficulties, however, of preserving a painted lath intact before it is applied to the building are practically insurmountable, and while the action of these corrosive agents may be retarded where the lath is not materially exposed, as on the inside walls and ceilings, the advantage of employing a rust-resisting material to hold the stucco on the outside and exposed portions of a building is obvious.

There has recently been placed upon the market an iron lath (called "ingot iron") which appears to have very great rust-resisting properties. The claim is made that it differs from ordinary iron and steel in that it contains a comparatively small proportion of uncombined carbon, sulphur, phosphorus and manganese, thus enabling it to withstand to a marked degree the corrosive action of the elements and of acids in the composition of the stucco.

A stiff-meshed ingot iron lath, tightly stretched and stapled to the sheathing over ¼ in. round ingot iron rods, set vertically 12 in. on center, and kept free from the building paper (with which the sheathing should invariably be covered) by iron rings previously slipped over the rods, would seem to present an exceptionally firm and enduring mesh for the reception of the stucco on a frame building. This method of fastening the mesh to the sheathing permits the stucco to cover and imbed the metal; the upright iron rods take the place of wood furring strips, and consequently cracks from the shrinkage and swelling of the wooden member are eliminated; and if lime is omitted from the stucco, and a small portion of hydrated lime used in its place to enable the mason to apply the stucco to the metal mesh with greater ease, a very satisfactory wall of its kind should be obtained.

There will be more or less movement, of course, in the frame

structure, according to the quality and condition of the wood, but with the use of well-seasoned and properly framed timbers, no serious cracks in the stucco veneer should occur with the employment of any of the methods described.

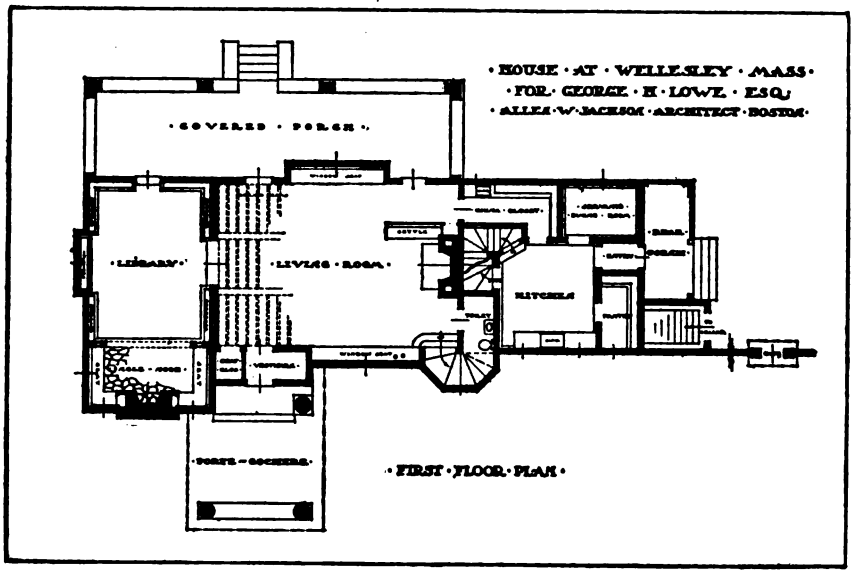
Many frame and stucco houses are being built to-day with walls improperly prepared and covered with stucco that lacks enduring qualities. Whether from ignorance or to save the first cost, the owners of these buildings will rue the hour that they decided to employ cheap or ill-advised methods. It is a great misfortune that the average man builds but once; but all the more reason, then, that he should seek or listen to expert advice. Knowledge of any kind of building construction is generally limited to that acquired by frequent contact with building operations, and the layman should hesitate long before dictating how his house shall be constructed. "A little knowledge is worse than none." While it is often difficult for the architect to prevail upon his client to spend a little more in good construction and to convince him that it will be a good investment and economical in the end, the day of stubborn opposition to such arguments is passing. We are beginning to build for posterity.

Stucco on Masonry

WE will now pass to the consideration of a more stable form of construction. But the Man of Moderate Means need not close the covers of this book as yet — not unless his means are very moderate indeed, and even then if he is willing to make a slight sacrifice in quantity to obtain quality, he may still bear us company. After all and despite the prevailing opinion held to the contrary, most people build larger houses than they need. The rooms may be too small — they generally are — but there are too many of them. There is almost always a room that is either unoccupied or rarely visited, yet this unused room is the cause of all the other rooms being a little too cramped, and consequently gives the feeling that the house itself is small. Were this "undesirable" removed and the same space redivided, rooms of sufficient size could be had and the small house would become a large one. So, many a man who could afford to build a house having outside walls of masonry or concrete has required, or has thought that he required, so many rooms that he has been obliged to shave the cost here and there. The first "shaving" is generally the elimination of masonry walls, substituting frame construction which is "almost as good" — particularly for a temporary habitation.

Here we have the chief curse of and principal retard to good building and worthy architecture with which this country is afflicted — building for the moment instead of for posterity. Of what avail are the time and energy spent in the solving of new architectural problems if the products are built of evanescent material? A superficial influence is all that can be attributed to buildings of this character. On the other hand, masonry

and concrete will tell the story of our struggles for many generations to come, and our descendants will profit by a thorough investigation of our mistakes. But assuming that we are not so concerned about the future and that our interest is more self-centered, a masonry wall has many advantages over a frame wall, both practical and esthetic. To begin with, it is firm. It does not shrink and warp and twist as wood is apt to do. It



First floor plan, residence of George H. Lowe, Esq., Wellesley, Mass.
Allen W. Jackson, architect

receives the stucco directly upon its face, avoiding the necessity of applying any receiving medium such as a frame wall demands. A masonry wall is generally thicker than a frame wall, and so it gives a deeper reveal to the doors and windows, increasing both their beauty by the casting of deeper shadows, and their serviceableness by providing means for more effectually draping the openings than a thin frame wall will allow. If the reveals are deeper on the outside, greater protection from the weather is afforded.

Residence of Victor Elting, Esq., Winnetka, Ill. *Howard Shaw, architect*

"The decorative possibilities of stucco are almost unlimited. Combined with 'half-timbers' it provides a striking contrast to these wooden members in color and texture"

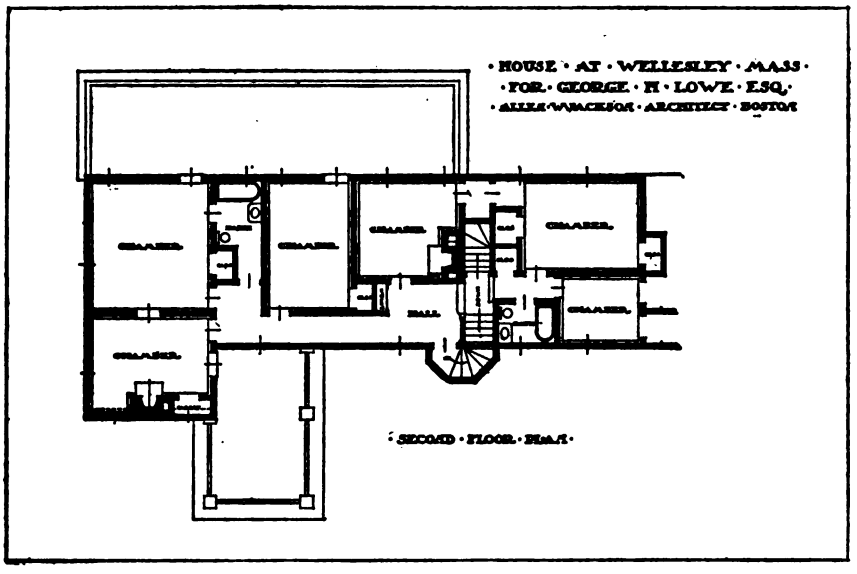
Residence of Percy A. Tomes, Esq., Garden City, L. I. *Alfred Hopkins, architect*

"Until greater attention is paid to the color of the aggregates, concrete tile walls will be stuccoed"

Residence of George H. Lowe, Esq., Wellesley, Mass. *Allen W. Jackson, architect*

"Of what avail are the time and energy spent in the solving of new architectural problems if the products are built of evanescent materials?"

Various kinds of material may be employed in building a masonry wall to receive stucco, and a choice depends upon cost or fancy. Where stone is plentiful but of a kind that is lacking in agreeable color or character, stucco may be used to advantage as a covering. Stone walls are built at least eighteen inches thick. This gives a deep window reveal which readily adapts itself to almost any form of treatment and combination of draperies,

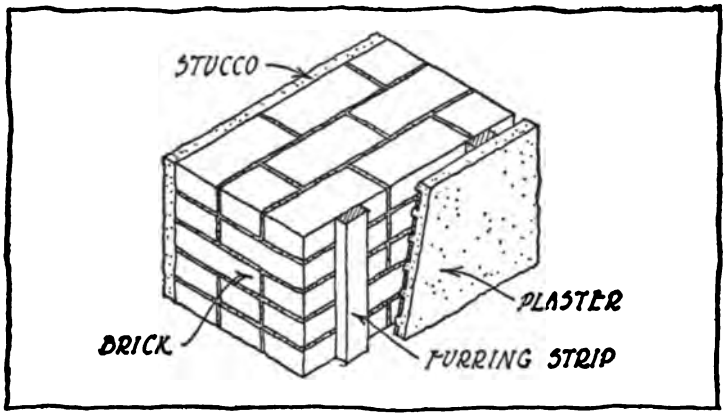


Second floor plan, residence of George H. Lowe, Esq., Wellesley, Mass.
Allen W. Jackson, architect

curtains, screens and blinds, often difficult to adjust in a thin wall. Common brick, laid in ordinary bond, makes an excellent wall for the reception of stucco. Second-hand brick, that is, brick from an old wall that has been demolished, may often be used, but they must be cleaned of all old mortar or the stucco will not readily adhere, and this cleaning process is apt to be costly, especially if the mortar is hard and difficult to remove. Some architects require the joints to be raked out a half-inch or more with the idea of giving a better "clinch" for the stucco,

but the author has found that a flush joint, provided the mortar is a fairly strong cement mixture, as it should be for stability and durability, forms a sufficiently rough surface to hold the stucco, and a saving is thereby effected in the cost of the labor of raking out the joints.

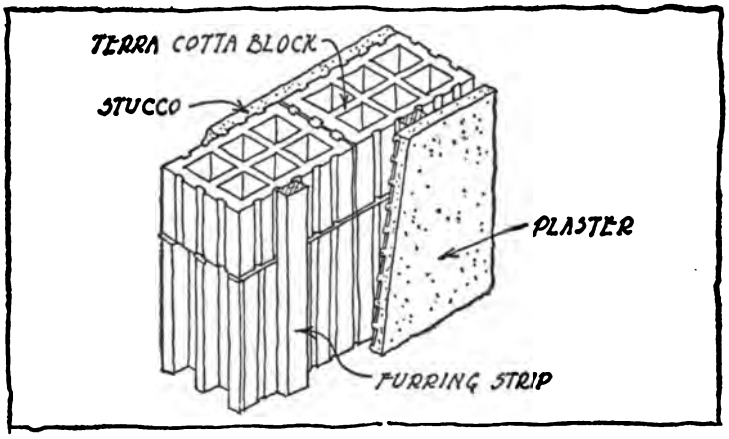
Hollow terra cotta blocks, both glazed and porous, have been extensively used in the construction of dwellings, the outer surface being covered with stucco. The author is not yet satisfied



Stucco on a brick wall. The furring strips are needed only on the inside

that a glazed tile is suited to this purpose; stucco does not readily adhere to such a surface. Furthermore, the danger is ever present of moisture penetrating the stucco and, held there for the reason that the vitrified tile permits no further progress in absorption, the probabilities are that, in freezing weather, expansion and a consequent destruction of the stucco will follow. The author once suggested to the manufacturer of a glazed tile that he disprove this theory by covering a sample tile with stucco, drenching it with water and allowing it to stand out-of-doors on a wintry night. The suggestion was accepted but was never carried out as agreed. Porous terra cotta tile is better suited to the reception of stucco, for the reason that it presents a rough surface and one where suction induces the stucco to adhere. As

in the case of brick, porous tile must be thoroughly soaked before the application of the stucco to prevent the absorption of too much water before the cement has had time to set. The irregularity of terra cotta tile and the necessity of laying it " on end," that is, with the webs between the air chambers vertical, in order to attain the strength necessary to carry its superimposed load, causes some difficulty in making a tight joint and in laying the tile, a considerable quantity of the mortar drops down into the

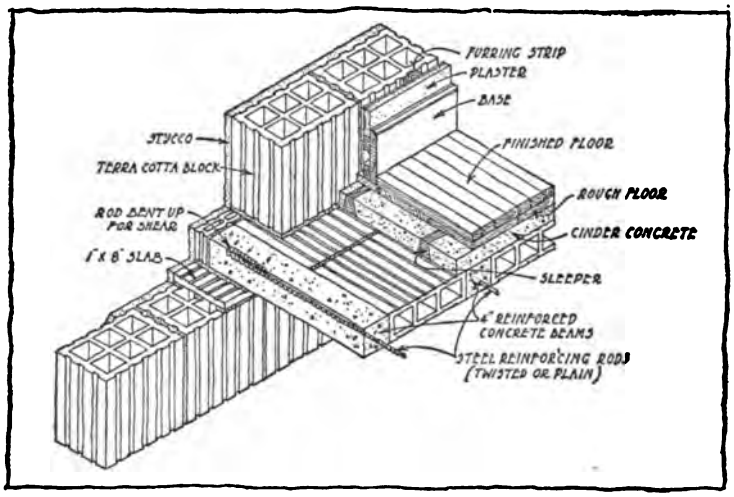


Stucco on terra cotta blocks. To prevent damage due to the condensation of moisture on the inside, furring strips are needed to hold the lath and plaster away from the wall

air cells and so is wasted. The difference in the coefficient of expansion between stucco and terra cotta tends to loosen the bond in changes of temperature and is apt to cause cracks to appear on the face of the stucco with almost as great frequency as when stucco is applied to a wood frame.

In conjunction with steel and reinforced concrete (eliminating all structural members of wood) terra cotta, when properly protected with a concrete facing, is fireproof, and for dwelling houses where a great degree of heat would not be so likely to develop in case of fire, the terra cotta block stuccoed on the outside and furred and plastered on the inside is an efficient fire-resisting ma-

terial. It is light and yet strong enough to bear the usual loads required in the construction of residences. The tile is made of burned clay and fashioned in a hollow form with connecting webs to insure strength. It is an enduring material, except that when heated to an intense degree and suddenly cooled by the application of water, it collapses. The claims made of its virtues are often exaggerated. The cost of tile construction exceeds that



A fireproof floor construction in combination with terra cotta tile walls Reinforced concrete beams support the tile floor arches, on top of which are laid wooden sleepers in concrete, the finished floor being nailed to the former

of wood by enough margin to cause it to be rejected in many instances. It readily absorbs water and is a good conductor of heat and cold, and the claim that the air spaces furnish complete insulation against atmospheric conditions is misleading. Owing to the rough and uneven outline of the block a good tight joint is not readily obtained, and as the block usually employed in building the outside walls of two-story and three-story houses is only eight inches thick, dampness is very apt to penetrate, especially if the stucco covering carries an admixture of lime. The air spaces formed in the manufacture of the tile are not

of a character wholly to insulate the rooms against heat or cold or to overcome condensation on the inside.

Stucco on steel frame has been employed in a number of instances but rarely in the construction of residences. This method of building has interesting possibilities, and may come into more general use when greater familiarity with its properties discloses more stable forms and more economical ways of construction and finish.

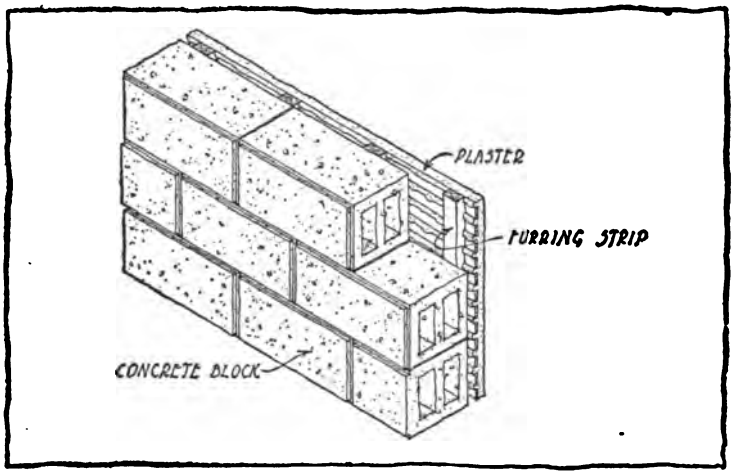
There is a great saving in the cost of labor when the difference in kind and size of materials employed is reduced to a minimum. In steel construction economy is sought and obtained in designing the structure in a manner that will require the least variation in the size of its members. And in the masonry construction of the future a similar principle will be employed in selecting for use labor-saving units, whether of stone, brick or concrete, of the size, color and surface texture demanded by the spirit of the design.

The Concrete Block

THE industry of hollow concrete block-making in America has been greatly injured by the fact that bad concrete blocks are so easily and inexpensively made. Cement and rubbish have been mixed and rammed into the simple machinery required, and building blocks poor in composition and monotonous in form and color have been turned out by the million and used to erect buildings that are eyesores in the community. There is no inherent defect either in the construction or in the esthetic properties of a well-made concrete block having a bush-hammered, tooled or plain face. In the hands of a skillful architect who appreciates the possibilities and limitations of the block, its use may be productive of durable structures of great beauty and dignity.

The so-called concrete block, meaning the "dry-process" block, of "stock" size, has been catering to popular favor for a number of years, but without marked success, no doubt because most of these concrete blocks are not concrete at all, and consequently do not perform the services anticipated from their promising name. Reference to page 16 will show that water is an important ingredient in the forming of concrete. The dry-process block has little acquaintance with water during its process of manufacture. Consequently it harbors an unquenchable thirst, and, when used in the outside walls of a building, it proceeds to make up for lost time, every rainstorm furnishing the elements of a "spree" to the detriment of the block. The dry-process block lacks the density and strength that are given to concrete by the admixture of a certain percentage of water (about eight per cent of the weight of the dry mixture), sufficient to make it plastic. Concrete of such constituency, when poured into a mold

to form the block, must obviously remain undisturbed until the cement has set sufficiently to allow the removal of the mold without injury to the block. This process is too slow for the exploiter of the "concrete block," so he eliminates a greater part of the water and proceeds to make his concrete dry, or barely moist, shoveling it into a machine that rams the mixture into a sufficiently compact form to enable it to be removed in the shape of a hollow building block — but it is not a concrete block, as

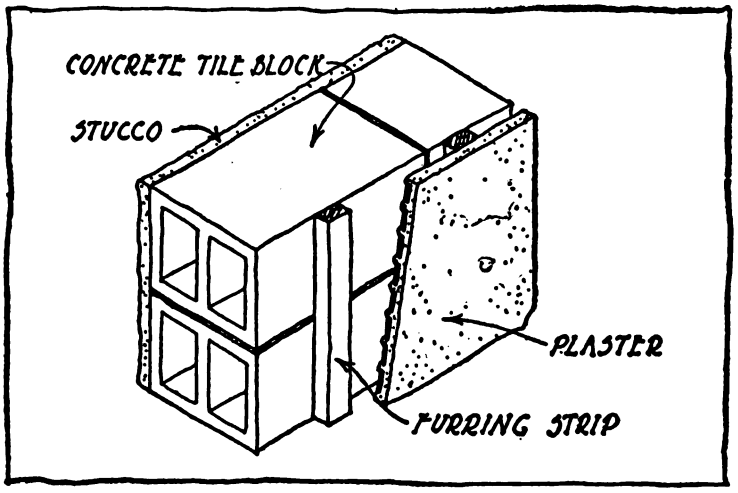


A wall of concrete blocks in which the outside face of the block projects very slightly beyond the joint edge

those who buy and use it learn to their sorrow. Even if made of the best material, it is merely a mixture of cement, sand and gravel, slightly moistened, and for the very reason that it lacks a sufficient proportion of water, it demands a supply after it is placed in the wall. Every masonry wall should be thoroughly drenched before the stucco is applied, but the so-called concrete block absorbs so much water that it generally takes all that a sprinkling will give it and such as is contained in the stucco beside. To make the wall impervious to moisture its face is then treated with a so-called waterproofing compound, but generally

without success. The underlying trouble with this type of block is that its composition is fundamentally wrong.

Blocks made from a concrete that has merely been moistened will always remain soft and weak, no matter how thoroughly they are afterwards sprinkled. The ingredients should not only be properly proportioned but thoroughly mixed. Just as a chain is no stronger than its weakest link, the stability of the block as a whole is no greater than its feeblest part. Careless mixing



A wall of concrete tile blocks with stucco applied directly to the face of the blocks on the outside, and the customary furring strips, lath and plaster on the inside

and the addition of too little water are more often the causes of a crumbling block than too little cement.

The sight, or mention, of the "concrete block" in its present crude form, especially in imitation of "cut" and "rock-faced" stone, has been sufficient to band the architectural profession together as a unit in protest and condemnation. Not that a concrete block, if treated as concrete, is in itself an artistic impossibility — witness brick which has achieved an esthetic value by reason of its own merit, but as a cheap and vulgar imitation of stone, concrete will never be acceptable in any work of worth.

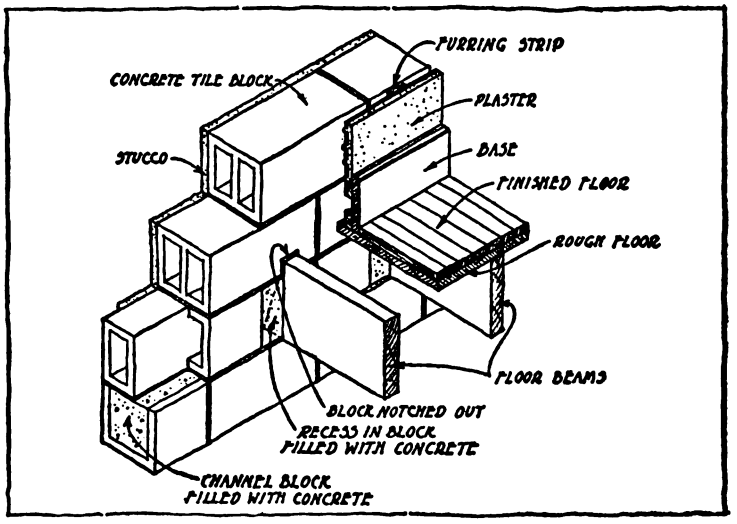
Residence of I. Rich Steers, Esq., Port Chester, N. Y. *Blake & Butler, architects*

"Concrete must always look like stone, because it is stone. But concrete is not quarried, and so it should never be made to imitate a rock-faced quarried stone"

Residence of E. S. Harkness, Esq., New London, Conn. *Lord & Hewlett, architects*

"No one can question the beauty of the proportions of this building nor the admirable effect obtained here by the use of the unveneered concrete block"

The glowing prospect of profits held out to the manufacturer has led a great many inexperienced men to employ methods that effect a saving in cost to the detriment of the product, in consequence of which vast quantities of improperly made blocks have been placed upon the market and used by others, equally inexperienced and deaf to every call but that of the Almighty Dollar, in erecting buildings that have proven to be damp and ugly. In order to quench the abnormal thirst of this dry block a kill-



A wall of concrete tile blocks with wooden floor beams and floors — a construction which is not fireproof

or-cure remedy was evolved in the form of a facing of a more dense mixture applied to the block and fashioned to imitate quarried stone. This monotonous and hideous mask sounded the death knell to the prospect of building up an industry of any great proportions. But it also set in motion the minds of men more experienced in the properties of cement and concrete, with the result that within a year or two there has appeared for building construction a concrete block, in substance as well as in name, that gives promise of being extensively used not only to receive a covering of stucco but to face the world with its own individuality. This block,

better described as a concrete hollow tile, is made of wet concrete composed of the proper proportions of cement, sand and gravel, with sufficient water added to enable it, when placed in the molds and subjected to a process that accelerates the setting of the cement, to acquire the properties of concrete and yet be removed from the dies with great rapidity. This new concrete product is true and even in form, light in weight, strong and durable, and apparently holds a stucco finish with permanency. The smooth and unusually large air cells afford a greater degree of attempted insulation against cold than is true of either the terra cotta block or the dry-process block, and, because of its density, far greater weatherproof qualities. It is cheaper to make and, because of its lightness and its true and even surface, it is easier and cheaper to erect than a heavy block or an irregular terra cotta tile; moreover, as the concrete tile is laid on its bed there is a minimum loss of mortar and a greater assurance of tight joints. When the joints are neatly pointed, the wall presents a clean and fairly pleasing appearance that will no doubt improve when greater attention is paid to the color of the aggregates. Until then concrete tile walls will be stuccoed. The coefficients of expansion of stucco and of concrete tile being approximately the same, the bond is not affected by changes of temperature and the stucco therefore adheres more readily than to terra cotta. For all purposes of country house construction concrete tile is fire-proof, and the proportionately large volume of air cells may overcome the necessity of furring the block to keep out dampness from percolation and condensation. Experiments to this end are being made, to the writer's knowledge, but a satisfactory test of the ability of this block to overcome the requirement of furring has not been made at the time this book goes to press. Altogether it is a very promising building material, and while time may uncover certain defects these will no doubt be quickly remedied, for the underlying principle of construction in this block is a good one.

Residence of E. S. Harkness, Esq., New London, Conn. *Lord & Hewlett, architects*

"In the New London house the blocks were made on the premises and surfaced with a carefully selected aggregate of coarse gravel pressed into a fairly wet mixture"

Residence of E. S. Harkness, Esq., New London, Conn. *Lord & Hewlett, architects*

"When properly mixed and formed, concrete is the most sanitary and durable of all building materials, and is susceptible of great beauty when care and judgment are exercised in the selection of aggregate of suitable size and agreeable color"

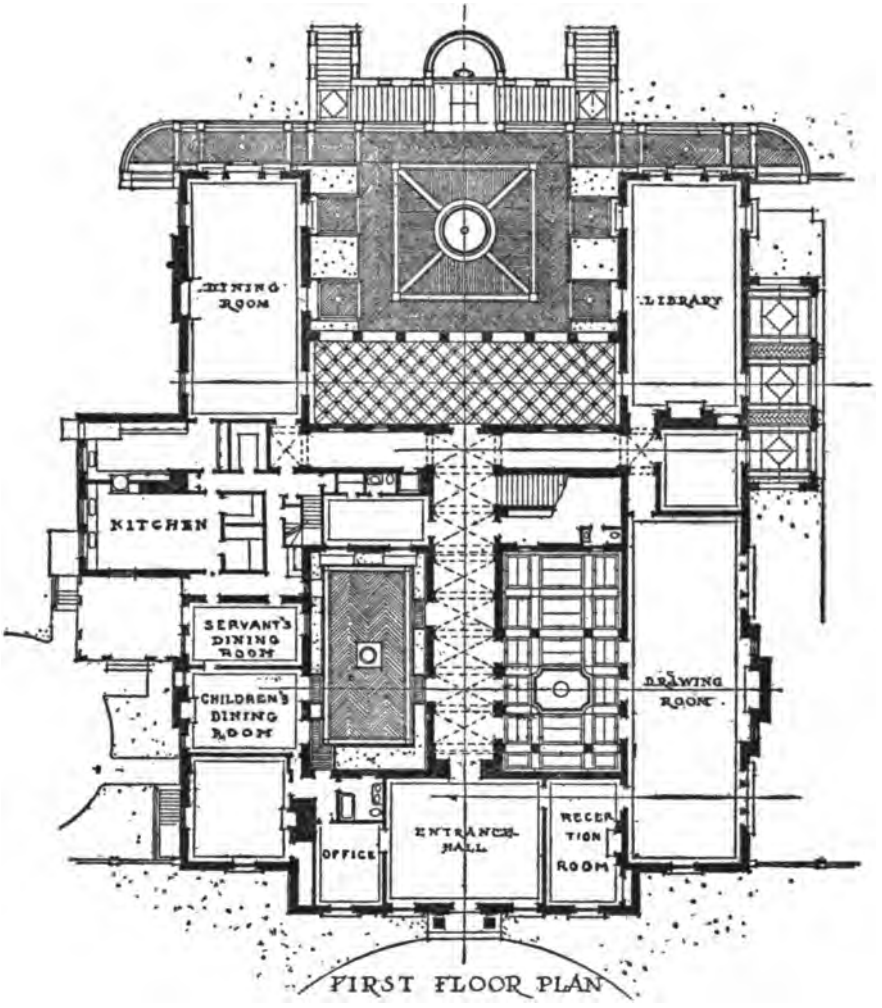
In the New London house illustrated herewith the blocks were made on the premises, of a size suited to the proportions of the building, nine by twenty-four inches, and surfaced with a carefully selected aggregate of coarse gravel pressed into a fairly wet mixture. After initial set the face was gently scrubbed, exposing the aggregate, and the blocks were given frequent sprinklings and then allowed to " season " for ten days. A clever ruse was employed to overcome the crude appearance of the arris at the joints by slightly projecting the face of the block to within about an inch of the joint, thus accentuating each block with interesting shadows. No one can question the beauty of the proportions of this building, nor the admirable effect obtained here by the use of the unveneered concrete block. Before it is generally employed by architects, the concrete block must be made of a dense mixture, therefore durable and waterproof; it must be furnished in any size or shape required by the architect's design; and finally, it must have a pleasing aspect and not be an imitation of any stone which in appearance is unlike concrete. Concrete must always look like stone because it *is* stone. But concrete is not quarried, and so it should never be made to imitate a rock-face quarried stone. The concrete block should stand upon its own merits, appear what it is, and not pretend to be what it is not. The most promising surface thus far obtained is by the use of a colored aggregate from which the dull film of cement is washed with a scrubbing brush and clean water.

Furring

CONDENSATION of moisture may often be observed on the inside of solid concrete or masonry walls and walls of hollow tile whose webs of similar material necessarily connect the inside and outside faces of the blocks. This phenomenon is caused by the difference in temperature between the inside face of the cold outside wall and the humid air which it encloses. The tighter the wall, that is, the more dense and compact it is built, the more apparent will be the condensation of moisture. Such a wall becomes cold in winter and stays cold so long as the winter lasts; it will radiate a chill through the room, and whenever the outside temperature rises, or a damp wind arrives, beads of moisture will be found upon the walls and ceilings of the room despite the normal heating of the house. This same phenomenon is noticed on the cold-water pipes in a damp warm cellar, or on a glass of ice water in a warm room. To overcome the chill from cold walls, and dampness both from condensation and percolation, " furring " is required. The word is derived from the protecting coat of animal fur. Furring consists in building a support for the plaster in such a manner as to provide an air space between the inside plaster and the outer wall. This may be done either by nailing to the wall wood or metal strips not less than one inch in thickness, to which the lath and plaster are applied, or by building a thin brick or hollow block partition, set at least one inch away from the outer wall, and upon which the plaster may be directly applied. A four-inch hollow block cut in two, with the webs laid against the outer wall, provides effective insulation.

It is necessary to fur all outside concrete or masonry walls,

including those built of hollow tile. The claim that the air spaces of hollow tile are a sufficient insulation against cold, and a preventive of condensation or sweating of the interior walls



First floor plan, residence of Harold F. McCormick, Esq., Lake Forest, Ill. Charles A. Platt, architect

in warm, humid weather, is not borne out by experience. Furring is not only necessary to prevent dampness from percolating through a porous outside wall, but to form a dead-air space

between a dense outside wall and the inside wall surface to prevent condensation. In other words, every structure built of masonry in climates where cold and dampness prevail must have two lateral walls — the supporting wall and a false partition or semi-partition called furring. The space so formed should be as nearly as possible an uninterrupted dead air cell. A free circulation of air tends to destroy the efficiency of furring. This requirement of furring is one reason why masonry construction is more costly than frame construction. Any well-built wall should be watertight above ground, and so-called waterproofing compounds applied to the exterior or interior surfaces of an outside wall do not produce this condition, when the wall is poorly built.

The unfurred wall has a champion here and there, but it is generally conceded that for structures intended to house human beings with any comfort, an air space between the outside and inside surfaces of the outer wall is for the present a necessity. Capillary attraction will draw the moisture through the wall wherever it finds the tiniest entrance, and unless the outer surface is made impervious to the weather, furring will be required to insure against the complete penetration of dampness. But then the evils of condensation remain to be overcome. Health and comfort demand that the outside wall of residences shall be furred.

"Whatever history we Americans have is of comparatively recent origin and a proper pride in native ancestry, in national blood and indigenous types and styles is largely a matter of future privilege"

Two views, residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"The styles of one century are readily traced to those of the century before, and in the best examples we find them modified to suit the conditions of a new environment"

Residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"The passage of a year or two is generally necessary before a newly built house blends happily with the surrounding landscape"

Fire-Resisting and Fireproof Construction

A TRAGEDY chronicled with startling frequency in the daily newspapers is the destruction of some large country residence, and while, fortunately, the lives of the occupants are rarely lost, valuable property and often priceless treasures are ruinously damaged, if not wholly destroyed. As long as people will build structures of wood in localities where the means of fighting fires are inadequate, frame houses, which need only a spark and a breeze to reduce them and their contents to ashes, often before the volunteer brigade has fairly tumbled itself out of bed and learned the location of the fire, just so long will a man's country home be in jeopardy, and his heart nourish a constant fear of the catastrophe that may visit him and his at any moment.

We spend millions of dollars annually for fire-fighting apparatus and organizations of all degrees of efficiency, yet as much wealth is annually wasted both in the destruction of property and upon insurance. Were communities compelled to build of fire-resisting or fireproof material, losses from fire might be reduced to a reasonable figure. Fire prevention would be far more effective and far less costly than fire fighting.

The lowering of insurance rates alone is often not enough of an incentive to employ fireproof construction, but if, as has been suggested, municipalities would find it expedient to offer a moderate reduction in taxes as an inducement to erect unburnable structures, the frame house would find few champions.

A few years ago the palatial country home of one of our prominent millionaires was completely destroyed by fire. Of the many priceless treasures it held, only a few were saved. The

loss to the owner is reported to have been over $1,000,000, but this huge sum is probably a low estimate considering the impossibility of replacing the collections of a lifetime. The outside walls in this case were built of masonry, and wood construction was used for the interior partitions and floors.

A few months later the newspapers recorded a tragedy in the burning of a residence at Long Branch, N. J. The burned body of a little girl found in the cellar, the mother and father at the point of death from burns and shock, and the other occupants severely if not fatally injured by jumping from the upper windows, is the gist of a gruesome tale. The report makes no mention of what material this house was built, but from the rapidity with which the flames spread it was evidently of a most inflammable kind. That no such catastrophes as these could have occurred, had concrete been the building medium employed, would seem to be a conservative statement of fact.

The public is often deliberately deceived or misled through ignorance into accepting as a fact the statement made that such and such a building is "fireproof." No building in which any material is used in its construction and finish that will be unable to withstand the heat likely to be generated by the combustion of the contents of the building, or the action of water upon the heated surfaces, is fireproof. The author recalls a booklet published by a cement manufacturer and illustrated with houses purporting to be built of "concrete," with an implication that they were fireproof, whereas a large percentage of the pictures showed houses that to the author's knowledge were built of wood frame covered with stucco. While this form of construction may be made more or less fire-resisting, it is by no means fireproof.

The great conflagrations that have visited certain sections of this country have demonstrated pretty thoroughly that there is but one structural material that can be relied upon to withstand great heat in conjunction with the streams of water which

Residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"Trellis-work is valuable in breaking up a too monotonous stretch of wall surface"

Residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"A masonry wall is generally thicker than a frame wall and so it gives a deeper reveal to the doors and windows, increasing both their beauty . . . and their serviceableness"

generally reach the heated surfaces of the building in an endeavor to extinguish the blaze, and that is concrete. Brick, stone, and plaster will crumble and iron bend. Terra cotta will fuse and at the touch of water fly to pieces. Girders and posts of heavy yellow pine will hold their loads more readily than steel and iron when exposed to flames. Concrete will disintegrate to the extent of possibly an inch and a half in the fiercest of fires, but if the size of the reinforcements and the thickness of the concrete covering to steel and terra cotta members has been designed with this eventuality in mind, no collapse of the structure will be likely to occur and the injured concrete surfaces may be restored.

The heat generated in a fire in a country residence by the contents of the building is not apt to be so great that any form of well-constructed masonry, tile or concrete, employed in the outside walls, floors and partitions, will be unable to withstand successfully the attack. When the roof is covered with tile, wooden rafters are often employed, for, with the attic floor constructed of fireproof or fire-resisting material, the chances are that the flames will not reach the rafters, or they may only be charred, or at most the roof will collapse without injury to the floor beneath.

The effect of a fire in a newly completed residence designed by the author some years ago, affords an interesting illustration of the efficacy of concrete construction against injury by fire and water. Mr. B—— showed wisdom and foresight in demanding an unburnable house, and the illustrations of his residence at Ardsley-on-the-Hudson, N. Y., show what has been achieved through the medium of reinforced concrete. This material has been used for the outside and bearing walls, and for the under-floor construction, with partitions and furring of hollow terra cotta blocks. The only structural parts of wood are the roof rafters, and these are covered with tile. The owner has announced that he will carry no insurance except on the furnishings, and he has bought

his freedom from worry over the possible destruction of his house from fire or general deterioration. For concrete, properly built, is not only fire-, damp- and vermin-proof, but it largely insures against future " repair " bills.

The style of the house may be termed a modification of the Spanish Renaissance, to which concrete adapts itself with especial readiness. The outside walls are finished with a pebble-dash of a warm gray. The consoles supporting the lintels, and the panels above the second-story windows, are of molded concrete cast from the sculptor's model in three colors — white, gray and yellow. The rafter-ends, window casings and all other outside woodwork, is stained a gray-black, and the roof is crowned with a yellow-brown tile.

A broad terrace, enclosed with a balustrade of manufactured stone and paved with yellow brick, adorns the west façade, from which a flight of steps leads to the lawn, while to the south lies the loggia overlooking the formal garden.

Between two of the gables there is a flat concrete deck, from which a broad view of the surrounding landscape is obtained, and to make this roof absolutely waterproof, the specifications called for the foundation to be covered with several layers of tar felt bedded in pitch. In preparing for this work, the pitch, contained in a small kettle, was being " cooked " over a coke fire, when the contents suddenly boiled over and in an instant the entire attic was afire. The workmen made a desperate effort to extinguish the flames, but owing to the intense heat and the fact that there was at hand only a rubber hose an inch in diameter, and a small quantity of sand, they were unable to make much headway. Fortunately a neighbor, seeing the smoke and the glare, hurried to the scene with a few hand-grenades, and the progress of the fire was soon after checked. The blaze did not last more than ten or fifteen minutes, otherwise the roof would have been completely destroyed. Most of the rafters were charred, but only

Residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"That the lay of the land, and the needs and characteristics of the inhabitants determine the style of architecture to be employed is an undisputed fact"

Residence of Harold F. McCormick, Esq., Lake Forest, Ill. *Charles A. Platt, architect*

"While our landscape may not closely resemble the environments of Europe wherein stucco abounds, it is a fact that a plastic architecture accommodates itself to almost any section of our extended possessions"

to a depth of a quarter-inch where the fire was hottest. A few of the dormer window frames and rafter-ends and about two hundred square feet of roof sheathing were badly burned and had to be replaced. If the attic floor had been built of wood or some other inflammable material, undoubtedly the whole building would have been consumed. On the other hand, had the owner indulged himself in a concrete roof, it is safe to say that there would have been merely the spectacle of a "bonfire," with no resultant damage beyond the loss of the pitch. Neither fire nor water penetrated the attic floor; in fact, there was nothing below the second-story ceiling to indicate the conflagration which had raged above.

Another similar incident is described as follows in the Doylestown (Pa.) *Intelligencer:*

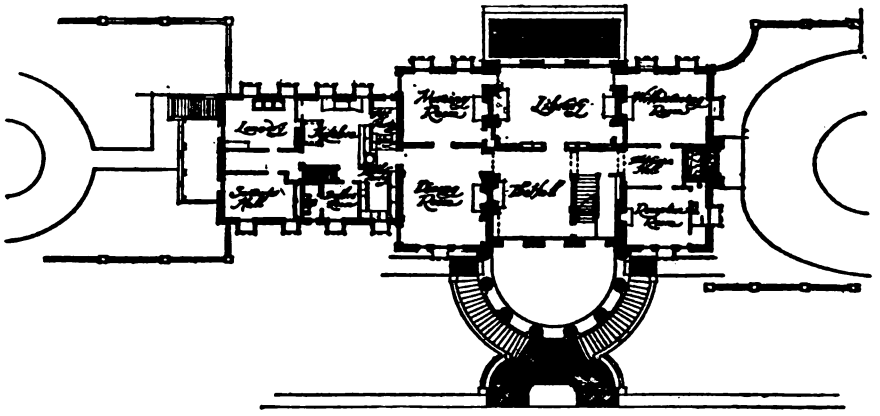
"With the mercury hanging about the 80-degree mark, at 9.30 Friday evening, an alarm of fire was given and it was reported that the barn at the home of Mrs. S—— on East Court Street was ablaze. In an incredibly short time the firemen had all the apparatus going out toward the scene of the alleged fire, and they had the hose attached when it was found that the alarm was a fake. The fire was only a blaze which H. C. M. had made on top of his concrete mansion farther out toward the Swamp Road, to celebrate his birthday which came on 'bonfire day,' but naturally anyone seeing the fire on top of a house at night would think the services of the hose company were needed. Nearly every resident of the town followed the fire company and the sidewalks were crowded for squares."

Cement Age comments upon this news item, as follows:

"This is the sort of story that is causing the insurance man to sit up and take notice, and likewise the citizen who wants an indestructible house. The structure referred to is of reinforced concrete throughout, and a fire could be started in any part of the building without endangering a single structural feature except the window frames. In some cases even these are made

of cement. Foundations, walls, columns, beams, floors, stairways and roof are all of indestructible concrete, and the bonfire on the roof of this house was placed there at less risk than would be the case with a fire in the furnace of an ordinary house. In fact, there was absolutely no risk."

Many houses of which the outside walls are built of stone, concrete, brick or hollow tile, with inside partitions and floor beams of wood, are often erroneously referred to as "fireproof." Obviously all structural members must have this quality before

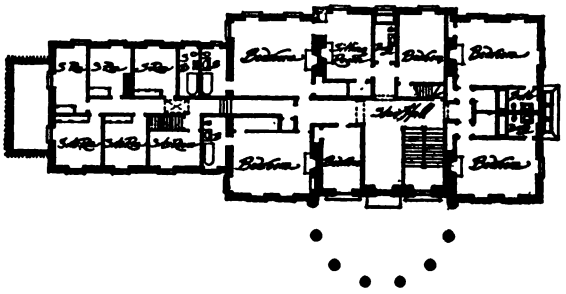


First floor plan, residence of Wm. G. Mather, Esq., Cleveland, O.
Charles A. Platt, architect

the edifice may be given such an appellation. Partitions which are not bearing-walls, and which consequently do not carry any weight but their own, may be, and are advisedly, built of some light material such as cinder concrete, hollow tile or various other non-inflammable products. It should be kept in mind that terra cotta and steel must be thoroughly protected with a covering of concrete to insure stability in the face of great heat and a sudden cooling by water.

A reinforced monolithic concrete foundation, made without forms and with a metal and frame superstructure covered with stucco, has been erected as follows:

For the foundation 6-in. expanded metal studs were placed 14 in. apart and stiff metal lath wired to both sides of the studs. The studs were braced by a piece of 2×4 in. scantling driven into the ground on either side as most convenient. The outside surface was then stuccoed and the inside plastered. This created a hollow form, 6 in. wide, which was filled with concrete, making a strong, substantial foundation wall. Above ground the walls were built of frame construction, except that in place of wood all posts and girts were formed of reinforced concrete. Metal ribs were then nailed to the wood studs and wire lath applied

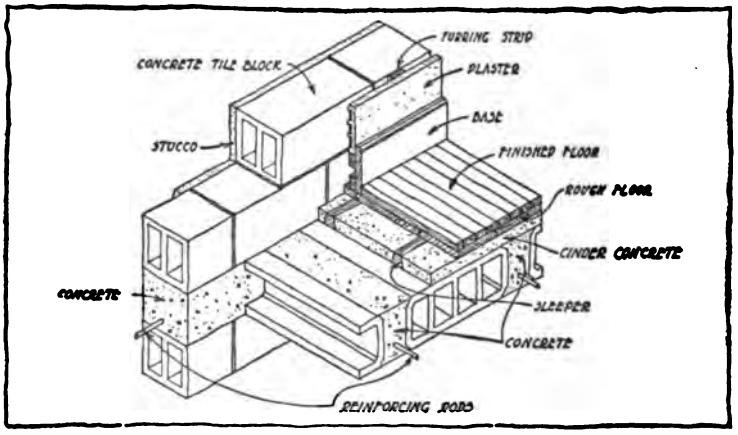


Second floor plan, residence of Wm. G. Mather, Esq., Cleveland, O.
Charles A. Platt, architect

in the usual manner, stuccoed outside and back-plastered inside so as to bury the metal. The inside face of the studs was then lathed with metal lath and plastered, providing an air space between the studs. If a dense mixture is used, this should make a durable and inexpensive wall, although it would be only semi-fireproof.

Fireproof floor construction offers a wide choice of materials with a variety of combinations. Steel beams supporting hollow terra cotta tile arches is one of the commonest forms employed, though it is often a more costly one than where beams of reinforced concrete are used. Concrete tile would seem to be a better and cheaper substitute for terra cotta, from the fact that it requires no fireproof covering and with reinforced concrete beams

makes a comparatively cheap floor. A thin reinforced concrete slab, formed between concrete girders, makes an effective floor when covered with cinders; in these wooden sleepers are buried to afford a nailing for the finished wood floor. While not strictly fireproof, a seven-eighths-inch oak floor so laid would not be apt to contribute materially to a blaze, and most people find a cement top objectionable as "cold" and lacking in richness and refinement. A quarry tile floor, laid on a cinder foundation, makes a



A concrete tile block wall with fireproof floors. Over the reinforced concrete beams, tile arches and wooden sleepers laid in concrete, are nailed the finished floor boards

handsome and absolutely fireproof finish, and a liberal sprinkling of rugs does away with any feeling of chilliness in its appearance.

To overcome the cost incident to the construction of forms for concrete beams and floor slabs employed in fireproof construction, a method of casting these structural members in standard sizes has been devised, as illustrated in the accompanying diagrams. The concrete floor joists and slabs are made and delivered by the manufacturer, and set, framed and finished by the builder, without the use of wood "centering" (forms), and without the necessity of mixing the concrete on the site. Where finished wood floors are desired, wooden sleepers are fastened with lag-screws to

Residence of Wm. G. Mather, Esq., Cleveland, O. *Charles A. Platt, architect*

"To build a temporary structure in which posterity has no interest when a lasting monument of equal beauty may as readily be had, would indicate that sentiment had overcome good judgment"

Residence of Wm. G. Mather, Esq., Cleveland, O. *Charles A. Platt, architect*

"The idea of an architecture for posterity has not yet aroused any general enthusiasm, and beyond an occasional example of individual foresight we are still building temporary structures"

the concrete joists at the time they are made, forming a solid and rigid nailing strip for the flooring. After the joists are set in place, the ceiling slabs are laid on the lower beveled flanges and the joint grouted with cement mortar. The floor slab is placed in a similar manner on the top flanges. If a cement floor is desired in place of a wooden floor, the wooden sleepers may be omitted and the cement finish applied directly to the slab. Where a semi-fireproof construction only is desired, the concrete floor slab may be omitted. Holes are left in the webs of the joist, both to facilitate the running of pipes and conduits and to lighten the construction so that it may be readily handled by unskilled labor without the use of derricks. A two- by ten-inch joist of this character weighs about twenty pounds a lineal foot, and for ordinary spans could readily be handed by two men. The deflection of a concrete beam is much less than of a wooden beam, consequently the ceiling cracks noticeable in most buildings where wood beams are used, are absent in concrete beam construction.

Technical descriptions of the various forms of floor construction applicable to fireproof houses would not be apt to influence the average reader's choice one way or the other, and this detail had best be left to the discretion of the architect, who may be trusted to select a method of construction that will best adapt itself to the walls, the cost and the desired finish. The sketches interspersed in the text will give an idea of the many types now in general use.

Reviewing America's contribution to domestic architecture during the last twenty years, gratifying evidence is everywhere apparent of an awakening to the practical value of esthetics in the design of the home, even though numerically the buildings of any real worth are not abundant. But while a great stride has been made in providing for the comforts and conveniences of the family and its employees, and in evolving pleasing types

of architecture, the vital question of durability and permanency of structure, the idea of an architecture for posterity, has not yet aroused any general enthusiasm, and beyond an occasional example of individual foresight we are still building temporary structures. This has probably been due more to the " American Idea " than to any other cause, to the demand for quick results, superficially attractive and casting a spell for the moment. We live and change too rapidly to spend any serious thought on the lasting properties of our wares. But we are growing older and wiser each year. Already the age of concrete is upon us and the dawn of a tomorrow discloses the dim outlines of masterly monuments rising from the decay and the ashes of yesterday.

Residence of Wm. G. Mather, Esq., Cleveland, O. *Charles A. Platt, architect*

"The softening tones which age will give to stucco improve its appearance"

Residence of Wm. G. Mather, Esq., Cleveland, O. *Charles A. Platt, architect*

"Although in city residences, commercial buildings, and many other types of structure concrete and stucco may be advisedly employed, the greatest artistic success with the use of these materials has been employed in country houses, their gardens and outbuildings"

Reinforced Concrete

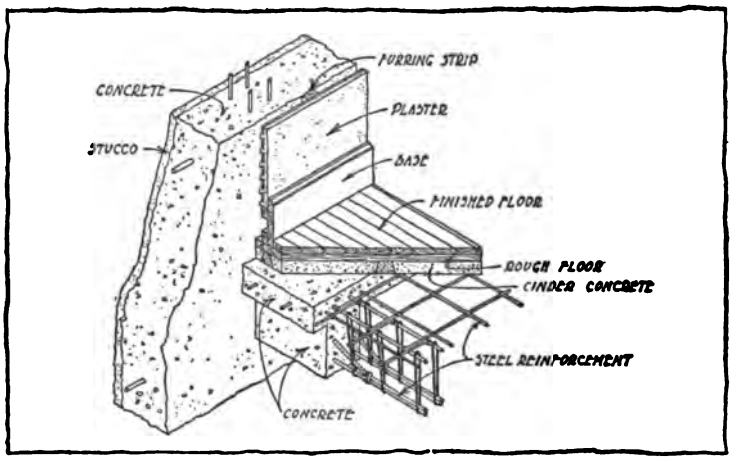
WHILE it is obvious that constructive materials with which we have greater familiarity will contribute to the realization of a native architecture, yet a great hope of its early fulfillment seems to lie in the use of reinforced concrete. It is the author's purpose in this and the following chapters to dwell upon the part which this medium will play, to outline its main characteristics as a structural factor, and to point out its artistic possibilities, indicating how they may reach a higher plane of rational art.

Truthful expression in architecture and the allied arts, as in science and philosophy, is essential to real and lasting worth. Of the two great mediums of architectural expression, articulated and plastic, the former, owing to its vital beauty, has been generally employed in all works of moment; while plastic architecture, because of its frail and transient quality, has been as diligently avoided except in structures of a temporary nature. The present-day custom of clothing naked steel with masonry, terra cotta and metal, and of giving to wooden buildings a veneer of stucco or brick, is a temporary makeshift, the offense of which to architectural morality may be partly condoned in a young and growing country where commerce and trade still overshadow all other forms of development.

The advent of reinforced concrete brings science to the aid of plastic art, insuring, at an ever lessening cost, greater stability and adaptability, together with endless opportunity for the expression of form, and gives consequent promise of an esthetic awakening of great significance.

It is hardly surprising that concrete has not as yet appealed

with great force either to the esthetic or economic sense of the architect and owner. The precedents of a wood and stone architecture are not lightly flung aside, and translated into concrete often become both far-fetched and costly. An avenue to the most effective use of concrete in residence construction is being sought through the medium of stucco, which has recently jumped into the front rank of building materials susceptible of expressing the requirement of domestic architecture; and the lessons learned



A reinforced concrete wall covered with stucco. The floor beams and supporting floor both show the method of reinforcement with steel rods

and the experience gained in the use of stucco will have their beneficial effect in suggesting the way to an architecture of concrete, where design will be expressed in terms of the material and executed at a reasonable cost.

Already has the potentiality of a molded architecture arrested and stirred the pulse of both the laity and the profession.

No longer need the architect be compelled to satisfy in day-dreams his yearnings for legitimate indulgence in plastic and chromatic art, as depicted in the beautiful but transient materials used in the architecture of the Orient, for fear of meriting poster-

ity's curse, if not beholding the ruin and decay of his handiwork within the bounds of a lifetime. With science at the helm and artistic precedent to illuminate the way, the vast possibilities of reinforced concrete, both in its structural and esthetic phases, cannot be measured.

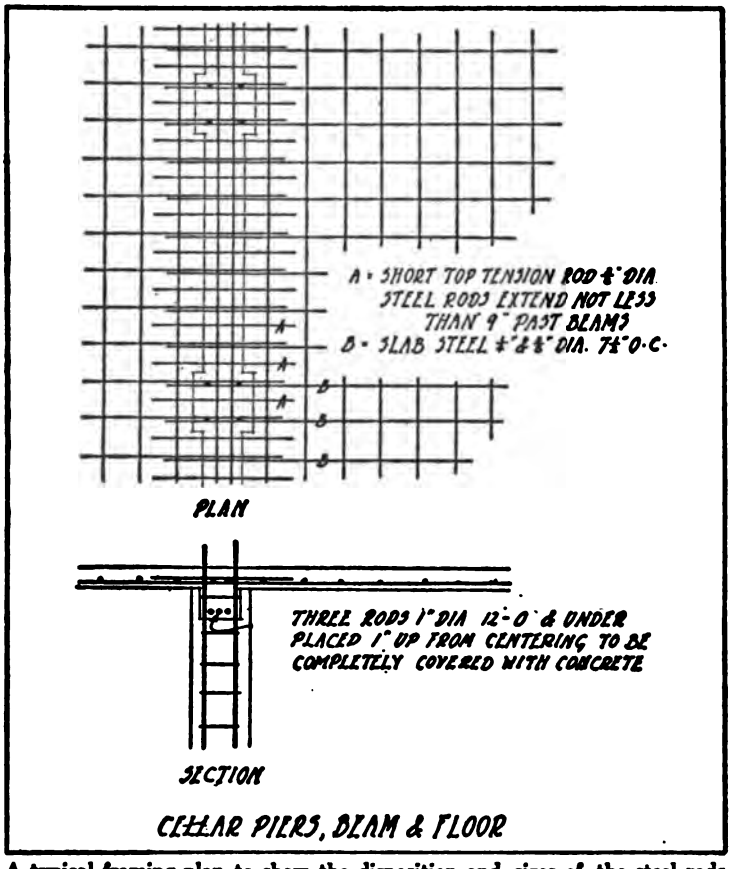
Who can say that from the interrelated masses of aggregate, cement and steel, a new and true architecture shall not be born, and that reinforced concrete, with its infinite field for esthetic and structural development, is not the long-sought "open sesame" to the goal of our patriotic architects, the American Style?

Heretofore, in America, adaptations from the Greek and Roman styles, and the various forms of the Renaissance, whether in truthful expression of function or not, have constituted whatever may be dignified by the name of architecture. We are styled "copyists" not without reason, although it would be unjust to condemn this practice out of hand, for after all it is in obedience to the law of evolution.

One of the most trying commands received by the architect is to provide something "original"; something odd and unlike what his neighbor has. This desire to be "different" is a healthy one and highly commendable, if not carried to an extreme. But many people are beginning to realize that to live among oddities is tiring to the eye and generally disturbing. Simple forms and harmonious colors, avoiding the conspicuous and the glaring, will generally be found to "wear well" and be the most productive of real enjoyment. It is a great mistake to suppose that there is no intermediate step between so-called originality (often perilously near to vulgarity) and what is termed commonplace. Taste employed in the modification of good precedent to conform to local conditions is invariably the safest course to pursue. Beauty of color and chastity of form find a parallel in harmony of sound and purity of tone. Our ears are generally better trained than

our eyes, and where we can readily distinguish between harmony and discord in music, we often fail to discover incongruity in form and color.

Taste is the product of personality and environment, and good



A typical framing plan to show the disposition and sizes of the steel rods used for reinforcing concrete work in a floor

taste is merely a measure of local standards. The Indian's wigwam and his beaded and feathered robe may conform as accurately to the precepts of good taste as the Englishman's country home and his faultless attire.

While there is no doubt that much of the slavish adherence

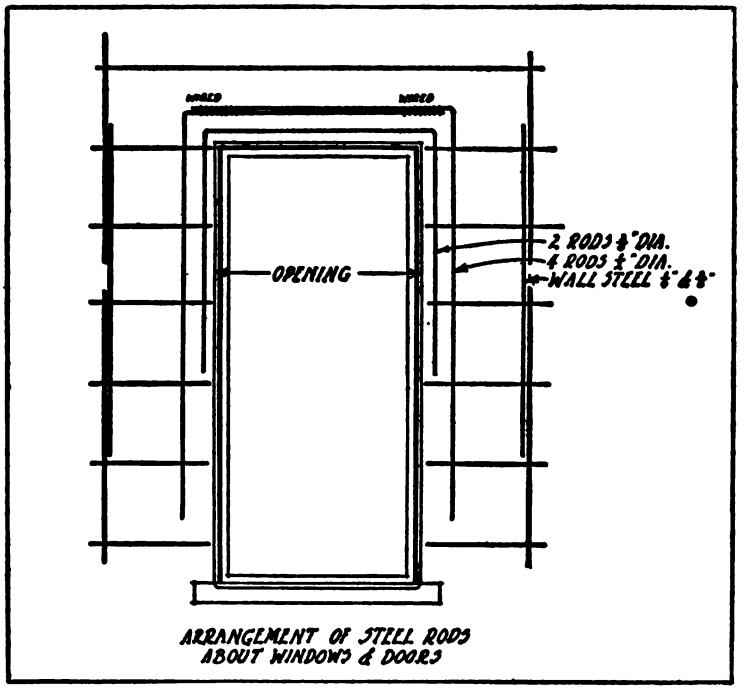
to the lines of the great masters, regardless of their functional truth, has had an educational value of large import in a country so young and raw as ours, in shaping a predilection and taste for artistic refinement, nevertheless a budding tendency toward picturing the purpose and functions of a building on its façade is a welcome sign of a return to the verity of Grecian and Gothic art.

The signs of the times indicate a decided advance in public appreciation of good art and good building. To be assured of this we need only point a finger to the tardy and costly remodeling which the City of New York is now undergoing. In but a few instances is the change retrogressive. The architect should feel exultant at the prospect before him, for no profession offers a wider field of promise than is opened to him in American Architecture. All the more serious becomes his duty to cultivate and guide the public taste. His work, unlike that of most other professions, is ever " in the public eye " and subject to daily comment and criticism. It stands a monument to virtue, or to iniquity, open to praise or to ridicule.

Men in other walks of life may successfully hide their failures. Even the engineer may temporarily cloak his defective structure with the architect's mantle. Endowed with such powers for good and for evil, there rests upon the architect a grave responsibility, demanding from him the highest form of mental and moral equipment. Let him show his capacity for good deeds, let him prove his worth, and the public can be trusted to give him place in the councils of the Nation.

The introduction of new appliances, new materials or new methods is usually viewed with suspicion. A departure from beaten paths is generally the signal to the sceptic to rush forward with denunciations and predictions of failure. The early history of reinforced concrete is no exception to this rule. It was attacked from every side by the ignorant and condemned on

every occasion by the " stand-patter." Like all worthy objects, however, it has flourished under persecution, until now it is employed to advantage in nearly every branch of construction and is destined to revolutionize architectural forms and inaugurate a new era of building. The opponents of concrete, who have sought to retard its use, have been obliged to yield little by little



Architects and engineers have already worked out trustworthy details for the reinforcement of various portions of the building

as practical demonstrations proved the fallacy of their statements, until in desperation they rallied to the cry of " no salvage." The fact that a concrete building could not be " wrecked " at a profit suggests that one of its virtues is a sense of humor! Reinforced concrete has not been in use a sufficiently long time for the question of salvage to be estimated with accuracy, but the recent razing of a reinforced concrete office building demonstrated that

the demolishing was readily accomplished for a sum less than the value of the materials regained. So it is evident that when such a building has lost its usefulness it does not become a "white elephant." Unsightly appearance is about all there is left to cite against this much-maligned material, but "coming events cast their shadows before," and the end of what appears to be a campaign dictated by fear and prejudice is heralded by recent achievements in texture and color.

The saying that "fools rush in where angels fear to tread," is nowhere better exemplified than in the handling and treatment of concrete in its recent chrysalis stage. Much has already been done to hinder its popular growth. Ignorant, careless or fraudulent builders have caused the collapse of concrete structures. A mistaken idea that it is a cheap material has led to the erection of numerous buildings of structural weakness and monstrous design.

Then again, concrete has suffered from the untempered enthusiasm of too hysterical champions, whose unqualified claims as to its fireproof, damp-proof and other excellent qualities have been accepted with disappointing if not disastrous results.

Finally, we come to perhaps the greatest obstacle in the way of its rapid and general use: How to give reinforced concrete a truthful as well as a pleasing expression. Let us first of all consider its physical properties.

Physical Properties of Reinforced Concrete

THE invention of reinforced concrete is claimed by both England and France, although it is probable that the properties derived from the use of metal in conjunction with a very ancient form of construction were known and employed in bygone ages. A clay composition reinforced with bamboo has been used in the houses of Russia, China and Japan. Reinforced concrete consists of a definitely proportioned mixture of aggregate, cement and water, with the introduction of iron or steel, placed in such a manner as to take up those stresses which cannot be resisted by the concrete alone.

It has been urged by some that a gradual disintegration of the reinforcement is inevitable, but wherever oxidation has been found, the cause was invariably traced to poor material or workmanship. When the concrete is properly mixed and thoroughly rammed around the reinforcements, a firm adhesion results between the cement and the steel, and the exclusion of oxygen in air or water prevents rusting. While its most familiar use is in the exterior walls of buildings, reinforced concrete is applicable to any form of construction with compressive and tensile strains usually employing steel, masonry or wood. For purely utilitarian purposes such as for tanks, vats, water-mains, reservoirs, etc., it has been found an excellent medium of construction.

As the resistance of concrete to rupture increases with time, it compares favorably with steel which requires constant attention and repeated painting to prevent rusting, and it has the advantage over stone and brick masonry of lightness and economy. Its superiority to wooden structures is in many respects quite obvious. Not the least important is that it affords no harbor

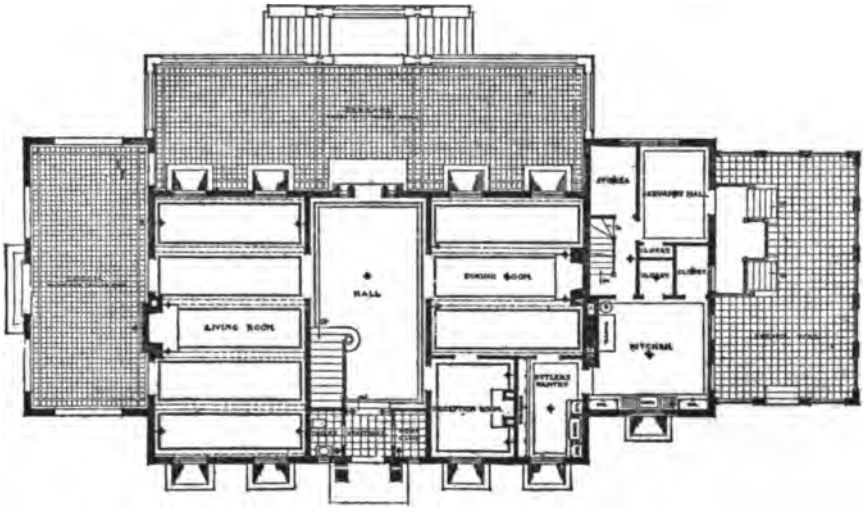
Residence of Daniel Bacon, Esq., Ardsley-on-the-Hudson, N. Y. *Oswald C. Hering, architect*

"Rough-cast and pebble-dash finishes . . . give a very pleasing texture and a variation in tones that overcomes the monotony of a perfectly smooth and uniform surface"

Residence of Daniel Bacon, Esq., Ardsley-on-the-Hudson, N. Y. *Oswald C. Hering, architect*

"The fact that reinforced concrete demands a new style of architecture is a shock sufficient in itself to account for much of the hostility towards this radical newcomer"

for microbes or vermin. Structures can be safely built in less time through the employment of reinforced concrete than through the use of any other material or combination of materials. The fire-resisting properties of reinforced concrete were well exhibited in San Francisco during the greatest conflagration of modern times. Tests have been made in which high temperatures have been withstood, and it was found that the thickness of the concrete surrounding the steel determines its heat-resisting efficiency.

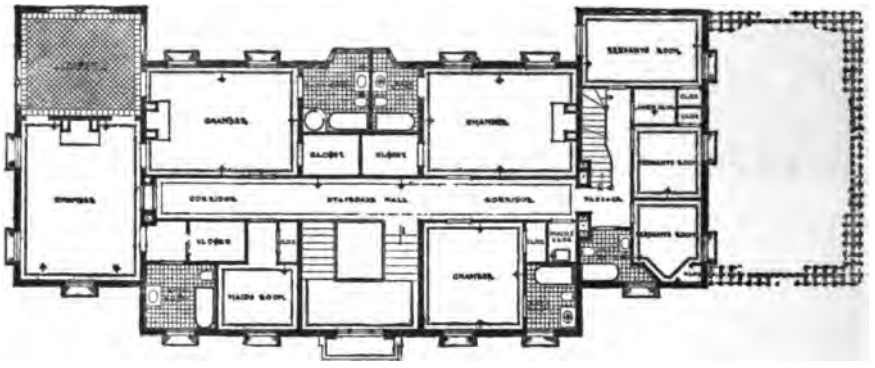


First floor plan, residence of Daniel Bacon, Esq., Ardsley-on-the-Hudson, N. Y.
Oswald C. Hering, architect

This thickness should not be less than three-quarters of an inch, and where it is planned to enclose a large percentage of inflammable material, the reinforcement should have at least a two-inch covering of concrete.

The disadvantages of reinforced concrete are few. Probably the greatest handicap in its use up to the present time has been the difficulty in securing proper materials and the best of workmanship. While unskilled labor may be employed, it is necessary to select those of experience in the making and handling of concrete, and above all, an intelligent and carefully trained fore-

man must be constantly in charge of the work, giving it close attention and supervision. The custom of awarding contracts to the lowest bidder may bring disastrous results. The cost would better be computed by a competent engineer and his estimate accepted by the owner and contractor, who should agree to share any actual increase or decrease in cost above or below the figures of the estimate. The temptation to " skimp " by a not over-conscientious contractor is great, as detection is sometimes difficult;

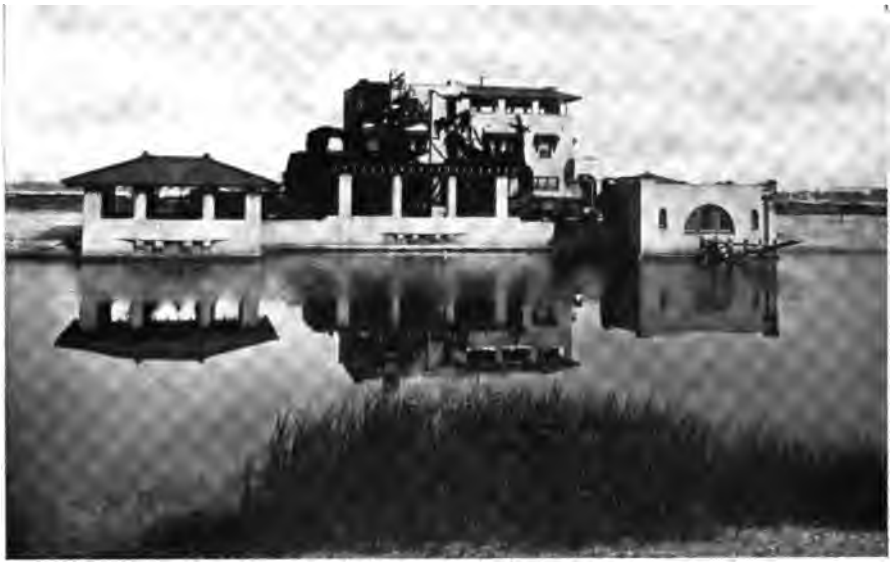


Second floor plan, residence of Daniel Bacon, Esq., Ardsley-on-the-Hudson, N. Y.
Oswald C. Hering, architect

consequently only men of well-known integrity and experience should be employed.

Owing to its great density, concrete does not readily receive and hold nails or screws, and any cutting or drilling is done with great difficulty and at considerable expense. For this reason the architect's plans should indicate the location of plumbing and heating pipes and the course of electric conduits, as well as the position of door and window trim, wainscoting, cornices, or any other finished woodwork, so that all chases and blockings may be provided for during the forming of the walls and floors.

One of the least desirable properties of concrete is that it readily transmits sound. It is frequently necessary therefore to employ double walls, bonded together at intervals, forming



"A certain amount of blending variation in tone is pleasing to the eye, while a perfectly even color lacks character"

Two views, Havemeyer house, Bayberry Point, L. I. *Grosvenor Atterbury, architect*

"From an artistic standpoint perfect uniformity of shade in stucco is not essential or even desirable"

Havemeyer house, Bayberry Point, L. I. *Grosvenor Atterbury, architect*

"Vines are as essential a covering to outside walls of masonry and stucco as draperies and pictures are to the inside walls of the room"

an air space between, and for non-bearing partitions it would be better to use hollow tile blocks. Over the floor slabs a covering of cinders is advisable, in which are embedded sleepers of yellow pine to receive the nailing for a wood floor. This construction not only deadens the sound between stories, but gives space for the running of pipes, and the cinders act as a cushion which overcomes the objection to a rigid floor.

Some danger is incurred by the use of concrete in freezing weather. This may be largely overcome by salting and heating the water, heating the stone and sand, and by covering and otherwise protecting the newly finished construction. In commercial work, time is usually an important element in calculating the cost, and the ease and rapidity with which concrete structures can be erected during inclement weather by the observance of a few precautions, should make the use of concrete popular for buildings of this character. The actual extra expense occasioned by the protective measures to be described will be far less to both the owner and the contractor than were the work delayed until the advent of warmer days.

Freezing will not damage concrete that has had an opportunity to harden under favorable conditions for from twenty-four to forty-eight hours. Freezing after this period merely retards the hardening process. Concrete that is frozen while it is still green, and green concrete that is subjected to alternate freezing and thawing, is very liable to be damaged. It is cheaper and simpler to lower the freezing point of the concrete by an admixture of salt, than to lengthen the time before the concrete becomes cold enough to freeze, by heating the materials. The first method may be employed without danger for temperatures no lower than 22 degrees Fahrenheit. Not more than ten per cent of salt should be used, and while it will retard the hardening and lower the initial strength of the concrete the ultimate strength will not be affected. For lower temperatures the materials should

be heated and the work protected. Heating the materials accelerates the rate of hardening and will insure the setting of the cement before it can be damaged by freezing, provided the concrete is promptly mixed and placed in position, and protected during the first few days. The sand, stone and water should be heated, although in thick walls it is not necessary to heat the sand if it is dry and free from frozen lumps. After the heated mixture has been poured into the forms, the exposed surface should be protected with canvas and steam-heated, or covered with boards or building paper, upon which should be laid a thickness of twelve inches of manure or an equally heavy covering of straw, kept dry. Manure should not be laid directly upon the concrete or the latter will be stained. Thin walls, columns, beams and floor slabs require especial care and protection, and salamanders should be employed about these to maintain the temperature near freezing or above that point.

Concrete in a large mass is the least expensive and the most durable and watertight of any form of masonry construction. The wooden forms required to hold the wet mass of cement and aggregate until it hardens into concrete do not constitute a large item in the total cost of the wall if the bulk is great in width, but when the mass narrows down to ten or twelve inches in width, as in the walls of the average residence, the ratio of the cost of the forms to the small amount of concrete they contain is very great; and herein lies the chief reason for a recent tendency to abandon monolithic wall construction in residences of moderate cost. The situation is not without its humor — especially to the carpenter.

It is the author's opinion, however, that this cessation is only a temporary matter and that before long some method of permanent interchangeable forms will be devised, possibly of metal (although the cost and particularly the weight of metal forms mitigates against their use), but more probably of compressed paper similar to "compo board," which may be fashioned to a

variety of sizes and shapes suitable for the usual plain surfaces and window and door openings of all residence construction, and which can be kept in stock by the building contractor for use on more than one occasion. Monolithic walls are not alone a truthful form of construction, but they present a fascinating field for the development of color and texture, and these virtues will no doubt find a means of expression within reasonable cost in view of the fact that the composition itself is simple and inexpensive.

Hair-cracks, often noticed on the face of a concrete wall, do not indicate a structural weakness of the wall. This surface crazing occurs only in a wet mixture rich in cement that has been allowed to dry too quickly. Dry concrete, being porous, and therefore defective in structure, is far more objectionable than a dense and waterproof mixture which may show superficial hair-cracks. Experiments have shown clearly that these cracks are produced by the contraction of the cement, the finer particles of which are carried to the surface of the wall and deposited there by the excess water which is absorbed in the process of evaporation, leaving a film of neat cement. These hair-cracks are more apparent on a smooth surface than a rough surface, and may be overcome only by keeping the surface of the " green " wall wet, and protecting it with wet cloths from wind and sun until the concrete has become thoroughly hardened. Experiments have also been made in mixing mineral oils with the wet concrete (about ten per cent of the weight of the cement) which indicate that the oil holds the excess water in the concrete, keeping the cement moist until the concrete becomes hard. As the period of evaporation has then passed, no contraction and consequent hair-cracks appear to occur.

We find, therefore, that the chief characteristics of reinforced concrete are a slenderness in structure combined with great resistance to tensile stress. Concrete can be easily and rapidly manipulated; it is less expensive than either clothed steel or ma-

sonry construction alone; it does not deteriorate with time, and it is practically fire and water proof. It grows in strength for a considerable length of time and, after having attained its ultimate strength, it never weakens. Consequently by its use, lighter, cheaper and more durable structures may be erected than with any other known materials.

Lacking, as heretofore employed, texture and agreeable color, concrete yet possesses a great facility for being shaped and molded, and its durability is unquestioned when carefully and properly made. With this general view of the structural properties of reinforced concrete, let us pass to the consideration of its esthetic possibilities.

Residence of Mr. James Grant Forbes, Esq., Dover, Mass. *James Purdon, architect*

"The fact that his house will stay put for centuries does not interest the American as keenly as does the assurance that it will not disappear over night with all his treasures"

Studio of Frederic Bartlett, Esq., Lake Geneva, Wis. *Howard Shaw, architect*

"An artistic rendering of reinforced concrete will occur through a frank manifestation of its own characteristics of lightness, delicacy and absence of deep shadows"

Esthetic Possibilities of Reinforced Concrete

THE momentous progress made during the last fifty years towards a broader and more comprehensive view of life, most clearly shown by the advance made in an industrial activity, in religious thought and in philanthropy, is largely due to scientific research and to a wider application of natural laws proving the falsity of many hitherto accepted traditions. The mind of the modern man has grown more analytical and his hunger for facts and thirst for truth have become well-nigh insatiable. This agitation has found only a faint echo in the Fine Arts, except in music, where everywhere the influence of Wagner's genius is now heard. In painting and sculpture, and to a lesser degree in literature and architecture, this revolutionary spirit has been felt, but as yet has exhibited no startlingly novel expression of real worth. The glare of "Impressionism," which twenty years ago lit the skies in the world of painting, has paled into the subdued light of dying embers. Enthusiastic exponents of L'Art Nouveau in architecture and the allied Fine Arts are extant, but their influence appears to grow less each day as their irrational products are viewed in the light of the laws of universal progress. In literature, the meager cult descendant from Walt Whitman's "individualism" illustrates well the folly of the revolutionist's single-handed attempt to achieve victory with the bomb.

In this vast onward movement the best results have always been obtained where there has been the closest adherence to scientific truths and a gradual, rather than abrupt, modification of existing customs to suit the new conditions. The nature of American civilization is not so much at variance with that of

Europe, that it invites an " indigenous " architecture in the sense that all precedent should be thrown to the winds.

There is unfortunately a tendency to propound this doctrine in certain districts of the Middle West, where products of architectural socialism rival some of the grotesque forms of the German *Jugend Stil.* A peculiar argument in favor of this " indigenous " style is that it may be adapted to the " temperament " of the client! As is well known, most of our clients — indeed close to a hundred per cent of them — have had no specific architectural education. Is a man's inexperience to be blazoned on the walls of his domicile to invite the world's ridicule? Is it not evident that the type of architecture derived from individual " temperament " would either resemble the vagaries erected by the self-qualified layman, or would clearly portray the idiosyncrasies of the architect?

The styles of one century are readily traced to those of the century before, and in the best examples we find them modified to suit the changed conditions of new environment, with new forms added wherever new functions made their creation a necessity. Whatever history we Americans have is of comparatively recent origin, and a proper pride in native ancestry, in national blood, and indigenous types and styles, is largely a matter of future privilege. There is one period in our young life, however, which ranks in importance with some of the Old World eras, and marks a conspicuous milestone in the progress and development of native art. The " Colonial Period," as it is called, is the foundation upon which we largely build, and it constitutes our main supply of available " precedent," that valued fund from which we draw, sometimes too prodigally, it is true, but from which, if discretion and intelligence are observed, the happiest results are obtained by adapting and modifying the characteristics of this attractive style to meet new needs and to fit new environments. To supply certain comforts and luxuries wholly

Residence of L. M. Stumer, Esq., Homewood, Ill. *Nimmons & Fellows, architects*

"Crude and wholly utilitarian at the beginning, concrete architecture will gradually acquire refinement and nobility from the teachings of experience"

Residence of L. M. Stumer, Esq., Homewood, Ill. *Nimmons & Fellows, architects*

"Reinforced concrete being sufficiently strong to bear any snow load, and a poor conductor of heat, the flat roof becomes the logical covering of residences built of this material"

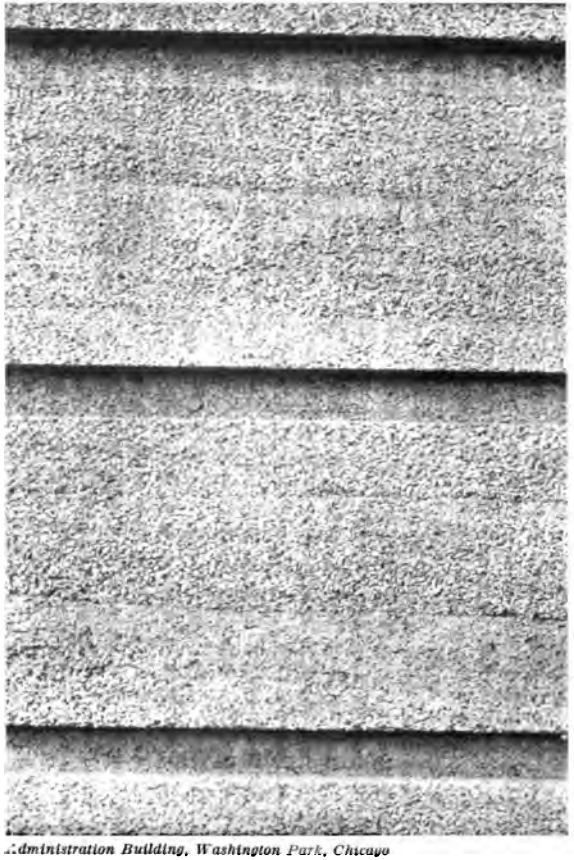
unknown to our New England and Virginian forefathers, there has been a tendency of late to shape the Colonial styles along the lines of the French and Italian villa, making possible a harmonious product combining the best features of these styles. In some instances brick, but more often stucco, has been the medium of expression employed by the architect in this evolutionary process. That he will find concrete more fit than either brick or stucco to carry his ideas to a logical conclusion is only a matter of better acquaintance with this promising material. Concrete adapts itself readily to a simple dignified architecture designed to include those comforts and conveniences that have come to be associated more or less with every American home. While our landscape may not closely resemble the particular environments of Europe wherein stucco and terra cotta abound, it is a fact that a plastic architecture accommodates itself to almost any section of our extended possessions, whether on the banks of the Hudson, the shores of Maine or Long Island, the plains of Kansas or the foothills of the Sierras. Concrete lends its color and texture to the beautifying of almost any class of habitation, whether villa, cottage or bungalow.

The path to a sane American Architecture will follow the general indications of the past and the present, and those who desire to win the first laurels will proceed along the rational line of a gradual and intelligent development of the forms with which we are already acquainted, but reshaping them to conform to the ever advancing knowledge of the many external and internal forces acting upon the structure, portraying its purpose as a whole and in all of its parts and placing it in harmony with its environment, the landscape, the neighboring structures and the spirit of the inhabitants.

The inherent properties of concrete, together with the cost, forbid its use along the lines of a wood or stone architecture. Cornices, string courses and elaborate ornamentation in concrete

are unreasonable and expensive. Simplicity in form is the dominating feature in concrete, and it will find its best expression as a background for concentrated ornament in brick and tile, or in the polychromatic effects of its aggregate. This compulsory treatment will no doubt evolve new forms and methods of construction and decoration sufficient to establish an individual style of architecture, linked only to those of the present and past by the conservatism of good art which knows no more violent change than is reflected in the life of the people. There are a number of styles which lend themselves to the treatment described, including most of those in which stucco has played a part, so that there need be no occasion for breaking away from all precedent despite the fact that many structural and ornamental devices which the architect has been accustomed to employ are prohibited by the essentials of a plastic material.

The structural problems that confront the architect in the use of concrete as applied to domestic architecture have, generally speaking, been solved. The stability of walls and partitions, the carrying capacity of floors and the spanning of openings, are matters readily determined. There are no structural terrors for the designer who understands the capabilities and limitations of his material. But this cannot be said of the surface treatment and finish of concrete. No structural unit or combination of units can equal in ugliness a concrete wall from which the forms have been stripped. This dingy, streaked and pitted mass, cold and lifeless, is too somber, too lacking in color and refinement to have any esthetic value. The architect has joined hands with the owner in a common prejudice against structures of monotonous gray which is the predominating color enforced by the use of Portland cement. To overcome these superficial defects is the chief problem that is bothering the designer in concrete at the present day. Color and texture must be obtained by masking or unmasking this repellent countenance.



Administration Building, Washington Park, Chicago

"Truthful expression in architecture and the allied arts, as in science or philosophy, is essential to real and lasting worth"

Residence of E. R. Marvin, Esq., Pittsburg, Pa. *Janssen & Abbott, architects*

Neighborhood Club, Chicago, Ill.

"There are several methods of surface treatment that have been employed with sufficient success to produce an interesting architecture and to suggest an avenue for study and development"

The first steps in this direction took the form of re-facing the crude wall with a paint or wash, and when this was found to give a flat, smeared and sickly surface, a coating of stucco was applied. Probably the best success in this method of resurfacing concrete has been obtained by pebble-dashing the walls, leaving the molded courses, such as bands, architraves, panels, and pilasters, to be finished smooth. In this way there is achieved a pleasing variety of texture and a contrast in light and shade.

There are several methods of surface treatment that have been employed with sufficient success to produce an interesting architecture and to suggest an avenue for study and development. Veneering or plastering the rough concrete wall with stucco is the most popular treatment to-day, though the tendency is towards a more truthful expression of the material evidenced by hammering and other methods of dressing and tooling, to give texture to the surface, and in the removing of the superficial cement by brushing or scrubbing the surface with water, or etching with acid, and so expose and brighten the aggregate. The method of using a colored aggregate is to be commended as combining both truth and beauty, but care should be taken not to bring it into such great relief as to leave the interstices open to the action of atmospheric forces, or the danger of damp walls becomes imminent, not to speak of a gradual disintegration of the wall.

Surfacing the wall while in the form can be done with the use of a false partition of sheet iron or steel held in place (after the wood form is erected) an inch away from the rough wall and the space between filled with the finishing mixture. This operation is carried on at the same time that the wall is being formed. Upon removing the metal partition before either mixture has set, the facing adheres to the wall. Another method of achieving the same result is in spading the concrete back from

the front of the forms and introducing the finishing mixture which at once unites with the concrete backing. These finishing mixtures may be of plain or colored cement mortar, or composed of cement and aggregates of broken stones, brick or gravel, depending on the color and texture desired. After the forms are taken off, however, the joint marks of the boards and the impress of the grain of the wood will be retained on the surface of the wall and these disfigurements must be removed before an acceptable finish is obtained. This is accomplished in several ways. The outer film of cement is brushed or scrubbed from the surface, exposing the aggregate of which an assortment, pleasing in color and well proportioned in size, has either been distributed through the concrete or brought to the surface by either of the two means described. The brushing or scrubbing process must be undertaken within twenty-four hours of the time the concrete is poured into the forms, and while the concrete is still green. For this reason the new wall cannot be carried at one operation to any considerable height or the load of its own weight would cause the wall to collapse. The scrubbing, which is done with an ordinary scrubbing brush and clear water, cleans the wall of the cement film which covers the surface of the concrete and throws the aggregates — the sand, gravel or crushed stone — into slight relief, producing a semi-rough surface of multicolored concrete. If for any reason the forms cannot be taken down until the cement has set and has become so hard that it will not come off by scrubbing, either with a bristle or wire brush, some method of tooling the surface may be employed, but the implements used should be of a kind designed for this purpose. Bush-hammering, picking and sand blasting are methods employed upon concrete that has hardened and from which the cement film cannot otherwise be removed, but these treatments are not to be recommended unless skillfully done, as the aggregate is disturbed by indiscriminate hammering, and

sand blasting, unless done with rare intelligence, cuts too deep on the soft spots and not deep enough where the composition is harder.

In erecting a wall of concrete to be scrubbed, it is usual to pour into the form not more than two or three feet of concrete at a time, removing the forms as soon as the concrete is stiff enough to carry its weight. The top surface should be kept clean in order that it may form a good bond with the next course, and any surface stains removed at the end of each day's work by washing the wall with water played upon it by a hose. After the building has been completed the entire wall surface should be washed with a solution of not more than one part muriatic acid to five parts water. This will brighten up the aggregate and bring out the colors. A stronger solution of acid will stain the surface with yellow streaks. Various other methods are employed to produce a pleasing finish to a concrete wall, depending on the character of the work desired.

It is a mistake to assume, as has been done, that concrete is too coarse and crude a material for use in obtaining and expressing refinements of finish demanded in the façade of a building having architectural pretensions. There would seem to be no limit to the delicacy in color and texture to be obtained, and while simplicity of form is a characteristic of concrete that cannot be ignored, the range of possible color and variety of texture, together with the ease with which it lends itself to the modeler's art, gives to concrete a promise of use in work of the utmost refinement. Colored sands may be rolled into the surface of wet concrete, producing very pleasing effects where a smooth surface is desired. A ceiling may receive this colored sand finish by plastering the bottom of the form with wet clay, to cover up the board marks. The upper surface of the clay is then sprinkled with the colored sand and the concrete poured in and well puddled and tamped. After the ceiling slab has hardened and the forms

have been removed, the clay is washed off, leaving the sand adhering as a face to the concrete slab.

A perfectly even color on the face of a concrete wall of any appreciable size is most difficult to obtain, and this fact alone has led many architects and owners to favor the use of some other building material. This question of monotone color in stucco has already been answered, and the same argument is applicable to concrete. While it is true that a badly built and improperly designed wall will become blotched and streaked in an unsightly manner, a certain amount of variation in color is essential rather than a handicap to the interest and beauty of the wall. The glory of brick and marble lies in the subtle coloring acquired with age, the gift of Time and its chemical agents. The modest shingle owes its sole claim to beauty from its property of weathering a demure gray, and to a slight deposit of dust and grime is due a large part of the "character" of Colonial columns and clapboards. Nature is the cleverest of all beautifiers and she may generally be trusted to enhance rather than despoil the beauty of any building worthy of her attention. Blemishes turn into beauty spots and discolorations become picturesque blendings of harmonious tones.

The author recalls a pebble-dashed house in Germantown, Pa., where through some misunderstanding the walls were tinted a vivid yellow. The owner turned a shade of purple when she beheld it and commanded forthwith that a coat of white be applied. Since then Dame Nature took a hand and washed the white from the projecting pebbles, leaving the recessed pockets to acquire a film of dust. A sparkling and mottled yellow, white and gray effect has consequently been obtained that never would have been possible in a one-tone mixture or with paint. It is conceivable that the owner should thoughtlessly apply the same rules for the treatment outside as inside, but that the architect should raise any objection to a harmonious variation in color of a

"Concrete adapts itself readily to a simple dignified architecture"

"Vines relieve the monotony of an expanse of wall and soften its rigid lines"

"A high degree of skill is required in casting concrete for steps, sills, copings, balustrades and the like, employed as exterior members in place of stone"

"Patching of stucco and concrete cannot be done after the cement has set, without producing a difference in color"

stucco or concrete wall and demand with the owner that it be spick and span is not so readily understood.

The successful development of the monolithic form of concrete depends largely upon the taste and care displayed in choosing the aggregates. These should be composed of various materials selected for color and texture and graded into not less than three sizes, from which the superficial cement is washed after the forms have been removed and while the walls are yet green. It would seem that the use of a polished surface clamped to the inside of the wood form, if not indeed constituting in itself the form, would insure damp-proof qualities in a wall of this character.

Pouring in the mixture wet to the consistency of a jelly and working the mass with thin rods, the smooth surface of the enclosure would tend to close the pores and give a similarly polished surface to the concrete. On removing the forms before the concrete could become too hard, and washing off the cement with clean water or dilute acid, a smooth surface would be left, resembling the familiar terrazzo floor, showing the colored aggregate but avoiding any interstices which would offer an entrance to moisture. Provision for polychromatic decoration could be made by leaving planks in the walls, if the decorative matter is not actually placed in position during the forming of the wall.

It should be borne in mind that a sudden and complete solution of a problem so vast and diversified in character is beyond any possibility. Step by step in the natural course of evolution, with patience, care and study, the present difficulties will be overcome.

The nearest field for exploiting reinforced concrete would seem to be in domestic architecture, and in certain types of buildings of no great altitude. For residences, particularly in country and suburban localities, concrete has already become an active rival to wood and masonry, particularly where facilities

for fighting fires are inadequate. These early examples have shown a marked tendency to imitate closely the lines and forms of the old Mission style — a false note at the very start, in that this type was a product of an environment of crude material and unskilled labor. Entirely different conditions exist to-day. The prevalent idea that beauty and refinement of form must be foreign to such an unprepossessing material as concrete is wholly erroneous. The most tender molding of mass and form along graceful and harmonious lines is merely a matter of clever design and deft manipulation.

The anatomical structure of a reinforced concrete building is properly expressed in its piers and lintels. Its chief factors are slender vertical supports and horizontal beams of great span formed in one continuous mass. The spaces between piers and beams are filled respectively with curtain walls and thin slabs. As the eye is not yet accustomed to such long spans, an impression of weakness is given that should be overcome by placing consoles or brackets at the union of pier and beam, or by arching the beam at this juncture. Similarly, as an impression of leanness and frailty might be obtained from the great distance between piers, from the shallow reveals of the openings and thin lines of shadow, an appearance of stability and vigor can be obtained by ornamentation, either sculptured, modeled, or incrusted, grouped or massed at salient points.

Granting the necessity for economic reasons of employing the gray cements in use at the present time, this neutral field yet forms an excellent foil to a carefully proportioned allowance of color from the application of tiles, mosaics, terra cotta, brick or sculptured stone, in the shape of panels, bands and friezes, as borders to the openings, and in all-over patterns on such surfaces as may occur between the main structural factors. There is nothing novel in the use of inlaid tile as a decorative treatment, as the architecture of Spain, Italy and the Orient will bear wit-

ness. It points a way, however, to the further embellishment of concrete, and while there is no reason to believe that works of the greatest architectural grandeur and splendor may not be achieved at some future time when concrete is as well understood as marble, the present experimental stage may be expected to produce a liberal sprinkling of unsatisfactory examples.

For rustic and informal uses, rich and highly interesting effects are produced by the use of small, irregular, unglazed tiles embedded in the concrete not only in geometrical patterns but grouped in a manner to form pictorial representations. These tiles may be secured in the forms and held by the concrete after it is poured in, or they may be cast in slabs of concrete and placed in recesses left in the wall after the forms are removed.

If unglazed tiles are used, the face of the tiles should be oiled and their backs soaked in water before embedding them in the mortar. The back of a tile should never be oiled or it will lose its porosity and power of adhesion. Oiling the face of the tile prevents it from being stained by efflorescence from the mortar in which the tile is laid. A glazed tile need not and should not be oiled, as no such action can penetrate a glazed surface. The tile may also be protected from surface staining from the wet cement by placing a piece of felt between the form and the face of the tile.

The rough texture of wire-cut brick especially adapts itself to the decoration of a rough-faced concrete, and very pleasing examples of this combination of materials have been obtained by using the brick in the form of sills, friezes and panels. Brick may logically form the spandrels and curtain walls between the piers and lintels characteristic of concrete construction, giving a pleasing and harmonious relief to the main structural members. Similarity of texture and contrast of color in these two materials offer a wide field for the most artistic decoration. Molded members cast in concrete with a smooth finish, popularly called

"artificial stone," may be used to great advantage as a frame for openings and for cornices, bands, panels and other molded parts in contrast to a field of rough, scrubbed concrete. These cast members may contain modeled ornament cast in colored cement, but care must be taken in the use of color not to weaken the strength of the cement by indulging too liberally in the use of pigments. Faience holds its color better than colored cements and is both durable and effective in conjunction with concrete, the latter being an excellent foil for faience trimmings and panels.

Wrought iron is especially suited to the decoration of concrete surfaces. It is often used in the form of window and door grilles, where the iron contrasts well with a wall of almost any color and texture. Fashioned to receive and hold flower-boxes, wrought iron receptacles are a particularly pleasing and logical embellishment to a concrete façade, and when employed for window balconies this material serves the double purpose of decoration and an excuse for using the casement window, which, when properly designed, is more serviceable, more healthful and far more beautiful of form than the rise-and-fall type.

Lattice or trellis-work is a valuable adjunct to stucco and concrete in breaking up a too monotonous stretch of wall surface and in concentrating the eye about some salient feature such as a door or an archway. It serves the purpose of a support for vines, and until these become sturdy in growth, affords an effective and inexpensive form of decoration.

Attention should be briefly directed to the manner in which reinforced concrete has raised the standard of esthetics in bridge building. To remove from sight the hideous iron and steel renderings that so often mar the landscape and to replace them as cheaply by structures rivaling in beauty and equaling in permanence the great stone monuments of the past, would alone place reinforced concrete in the foremost rank of building material.

Detail of Guggenheim Residence, Elberon, N. J. *Carrère & Hastings, architects*

"Education in every line of thought begins with the task of copying something that has already been done. No one is quite original, not even the lunatic"

Residence of R. A. C. Smith, Esq., Greenwich, Conn. *Oswald C. Hering, architect*

"Skilled artisans are necessary to obtain thorough and lasting results as well as an artistic rendering in stucco and concrete"

Manufactured Stone

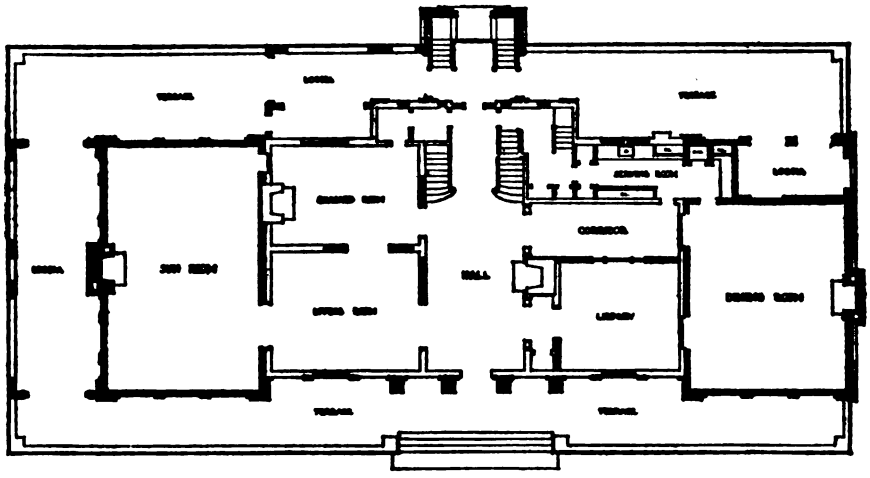
A HIGH degree of skill is required in casting concrete for steps, sills, copings, balustrades and the like, employed as exterior members in place of stone, but when it comes to the construction of objects of art, such as mantels, vases, tables, benches, sundials, statues, fountains and various other ornaments used for indoor decoration and for the garden, skill must be combined with infinite care and attention.

The illustrations are of interest in showing the success which intelligent and painstaking workmanship has achieved in executing in a much less costly material, architectural ornament that formerly required for its medium of expression, granite, limestone or marble.

The advent of white Portland cement has increased the output of manufactured stone very materially for the reason that a greater variety of color has been made possible through its use, alone, and in combination with the gray cements and pigments, although on the other hand its abuse is shown in the many examples that have the appearance of being made of plaster. When properly used, however, white cement in conjunction with judiciously selected aggregate is capable of producing very beautiful objects resembling marble and light-colored stone.

Models for ornamental concrete castings that are to have a tooled finish are generally prepared in a composition called "plasterline," instead of in clay, for the reason that clay has not sufficient stiffness to impart the impress of the tool marks upon the plaster which envelops it for the purpose of forming the mold. In properly executed work every tool mark on the model is reproduced in clean, sharp lines upon the finished prod-

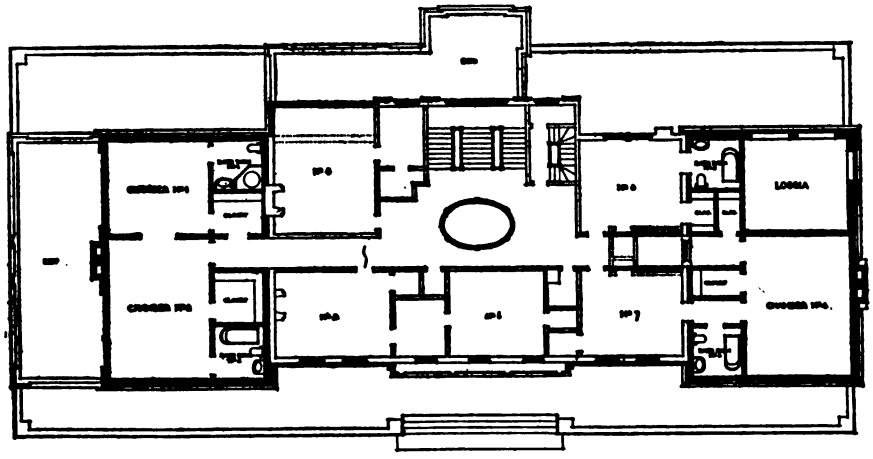
uct, the impress being taken when the wet concrete is poured into the mold and tamped. A dense mixture should always be employed, for the introduction of one of the so-called waterproofing compounds as an ingredient weakens the mixture, while surface applications that would not injure the appearance of the object, are not lasting. Coarse marble dust may be used as an aggregate where white or light-colored objects are desired, care being taken to avoid the fine grades, as the cement requires a gritty substance



First floor plan, alteration to residence of R. A. C. Smith, Esq., Greenwich, Conn. Oswald C. Hering, architect

to insure a good bond. Greater strength in this respect is achieved in the use of an aggregate of crushed granite or limestone screenings which, when mixed with a proper proportion of cement and carefully tamped into the mold, gives a stony texture of sufficient density and evenness of line to be retouched, or even extensively tooled, after the casting is made. The mixture should not be too wet or surface crazing will occur, and an uneven mixture may result from the segregation of the aggregate, so that some areas will be "rich" and others "poor" in cement. This will produce a casting that lacks uniformity both in strength and

color. The general complaint that the arrises (edges) of concrete are apt to be irregular and easily marred, may be overcome if care is taken in properly preparing the mixture, in filling the mold and in removing it so that no arris is broken and no patching required, and if sufficient time is allowed for the casting to "season," by which is meant keeping it wet for a month or more, either by sprinkling or submerging it. Architectural details such as balustrades, copings, sills and lintels, are frequently



Secondfloor plan, alteration to residence of R. A. C. Smith, Esq., Greenwich, Conn.
Oswald C. Hering, architect

cast on the site of the building. Rails and copings, if not cast in lengths of over four feet, need not be reinforced, as they will not shrink, but the sections should be doweled at the joints when set in place and the joints pointed precisely as with stone. The material used should be monolithic and should not have a core of any other material, for otherwise sandpapering, tooling or other methods of finishing might cause the outer surface to break off. In making balusters these should be cast from the end of a three-piece mold, a diagonal mold being employed for a square baluster. If the material contains the proper ingredients, thoroughly tamped into the mold, the product may be stripped in

thirty hours, any defects patched while the concrete is green, and then sprayed or immersed in clean water. Patching of stucco and concrete, as has already been said, cannot be done after the cement has set without producing a difference in color, no matter how careful the workmanship may be. Bases, bands and other flat members may often be more readily and more economically "run" or modeled in place than cast and then set in place.

Climatic conditions in this country, particularly in the spring and fall, when frost alternates with warm temperatures, are severe on all kinds of concrete construction, but provided the concrete is well made it should suffer no greater disintegration than the hardest stone exposed in a similar manner. So far as stains and discolorations are concerned, much the same may be said of concrete garden furniture as of the walls of the house — that the weatherbeaten marks of age improve the appearance of these objects, and unless the initial stains are due to physical defects they are not necessarily objectionable.

There is no doubt that manufactured stone affords a legitimate and attractive field for expression in decorative design. Thorough training and long experience are necessary, however, both on the part of the designer and the maker, to produce acceptable compositions. Knowledge must be had of what is practical and desirable in design, of the quality and behavior of the materials employed, and of how to make the models and the molds, whether of sand, of plaster or of gelatine. The first rule that should govern manufactured stone is the necessity of employing honest and intelligent labor. A disregard of this requirement is the cause of many worthless concrete products. It is impossible to make beautiful objects in stone or marble with cheap and ignorant labor, and the same may be said of manufactured stone. The architect may, for example, write a most carefully prepared specification for such ornamental castings as his design calls for, but if he cannot obtain the services of experienced and intelli-

Residence of E. R. Kellam, Esq., Pasadena, Cal. *Robert David Farquhar, architect*

"We are still more or less in the copying stage, though the beginnings of a desire to adapt tradition to present needs are noticeable in the more recent examples of our best architects"

"When it comes to the construction of objects of art such as mantels, vases . . . skill must be combined with infinite care and patience"

gent mechanics properly to execute the work in accordance with these instructions, the finished product will be unsatisfactory no matter what the cost. The art of making ornamental objects in concrete is very old, and the fact that examples exist to-day is due to the time, care and intelligence employed in their manufacture. "Rush" orders were not so common in olden times and the work was not hurried, and therefore of necessity slighted, as so often is the case to-day, more particularly in America.

Ornaments in manufactured stone are extensively made at the present time in Europe, where the art is more advanced than in this country, as imported works would indicate, but the growing appreciation on the part of the public of the possibilities of this branch of the cement industry, and the increasing attention given to questions of design and construction, are fast producing better results. The time would seem to be not far distant when concrete will very largely supplant marble and stone where castings are practical. These should not be termed "imitations" of stone, for the ingredients are largely the same as are found in real stone. Nature's process of employing time and gravity has simply been superseded and accelerated by Man's mechanical ingenuity.

The Dawn of American Architecture

A WRITER on architectural subjects has said that American architecture seemed to be the covering of one thing with another to imitate a third which if genuine would be undesirable. This will not be said of renderings in reinforced concrete, which usually have been aggressively truthful.

The architectural creations in the styles of bygone times that are worthy of note have portrayed the characteristics of the people at a high stage of their mental and moral development. The rise and fall of a nation is unconsciously pictured in its architecture. We Americans are no exception to the rule. We have had no architectural "style" since Colonial days, because since then our civilization has been growing so rapidly, and changes have occurred in our method of life so frequently, that an artistic expression of our national life has been futile, if not impossible. We outgrow each new idea before we fairly have a chance to use it. We welcome the cable car as an improvement on the horse car and no sooner install this mode of transportation than we rip it out in favor of electric propulsion. We become bicycle-mad and build up a great industry to supply us with this agreeable form of locomotion, only to throw our treasured "safeties" into the scrap heap at the first honk of the automobile. And now comes the aeroplane with its growing bid for popularity, and they say the automobile has had its day. The steel-skeleton office building of fifteen stories scarcely earned its title to one of the wonders of the age before it was torn down to make way for the "skyscraper." The contents of this book could be doubled by a recitation of the "improvements" that have come within the past fifty years alone, one upon the heels of the other,

Residence of Edward L. Ryerson, Esq., Lake Forest, Ill. *Howard Shaw, architect*

"When we settle down, we shall have an architecture"

Residence of E. E. Boynton, Esq., Rochester, N. Y.

Frank Lloyd Wright, architect
Pilkin & Weinrichter, landscape architects

"Whether a native style is to be realized through reinforced concrete or some other medium, the prime factor to be observed in following any style is honesty of purpose"

each sweeping its predecessor out of the way almost before according it a decent welcome. How, under such disturbing conditions, can we as a nation possibly expect to be pictured in an architecture of any force, clearness and dignity? When we settle down, we shall have an architecture.

Education, in every line of thought, begins with the task of copying something that has already been done. No one is quite original, not even the lunatic. We are still more or less in the copying stage, though the beginnings of a desire to adapt tradition to present needs are noticeable in the most recent examples of our best architects. We are also busy experimenting in the use of a lot of new building materials of which our forefathers knew little or nothing. Among these reinforced concrete has roused more than curiosity. The pictured possibilities of this union of steel, cement and crushed stone created an enthusiasm so great as to give it a black eye almost at its birth by reason of the blunders committed in design and construction. Sober reflection and a careful study of the properties of reinforced concrete, and of the lines along which it may be rationally developed, will no doubt soon contribute new and better examples in construction and appearance. A thorough appreciation of the characteristics of the material used is a first requirement for the success of any design.

Concrete is not yet generally understood, and, resembling stone as it does, the first tendency of the designer was to employ it in the performance of the functions of stone and consequently as a cheap imitation thereof. The result was dismal failure that brought down a storm of criticism, not so much of the employer as of the innocent employee. The principles of design in Classic and Gothic architecture are not successfully employed in terms of reinforced concrete. In articulated design the area of the wall surface always exceeds the area of the openings, due to the physical restrictions governing the length of a stone lintel

in the performance of its task. Reinforced concrete is capable of far greater spans, and consequently the proportion of piers to openings is the reverse of that in stone. It is not necessary, however, for these structural "openings" to be filled with glass. A part of the area between the piers may contain windows and the surrounding field may consist of any material suited to the purpose of the building. Again, forces expressed in the vaulted and buttressed arch of Gothic design have no significance in a similarly shaped arch of reinforced concrete.

The forces of reinforced concrete suggest, therefore, certain departures from accepted forms utilized in wooden and stone architecture. For example, in place of the straight horizontal beam and the semi-circular masonry arch, there appears the flattened arch with brackets at the point of juncture of beam and column, a weak point in concrete construction and logically strengthened by these corbels. The beam of long span is a characteristic of reinforced concrete, making possible a room of great area without the necessity of supporting columns and at comparatively small cost. Again, there appears the flat roof as distinguished from the pitched roof. The latter was almost always constructed of wood, and served the various purposes of providing needed space for living-rooms, for storage, as an "air space" for the better comfort of the occupants of the story below, and for shedding rain and snow. The pitch grew steeper in regions where snow and ice prevailed longer. Reinforced concrete, being sufficiently strong to bear any snow load, and a poor conductor of heat, the flat roof becomes the logical covering of residences built of this material. Aside from logic, the adaptability of a flat roof for use and enjoyment is self-evident. The attractions of the roof garden in civic architecture suggest a loggia treatment for the top story of the country house as pleasing in appearance and delightful in use. The familiar ground-floor loggia which is gradually supplanting the columned porch in popularity,

"Casa del Ponte," Rowayton, Conn. *Slee & Bryson, architects*

"The bolder spirits of the profession will not fail to translate the handwriting on the wall as the beckoning of opportunity"

The Voorhees Residence, near Philadelphia, Pa.

"Only through the truthful expression of aim and function and a simple and durable construction, can our architects hope to win lasting honor and fame"

because of the readiness with which it can be screened in summer, and glazed and heated in winter, has become such a magnet as to draw the family hither to the neglect of the old-fashioned "parlor" — even the modern living-room is deserted in favor of this newcomer made fascinating all the year round by " invisible " screens, fireplace and auxiliary heating. Were the roof to be crowned with this solarium, the temptation to abandon as well the dining-room and the sleeping-rooms would appear to be warranted. It is hardly necessary to state that these new forms can be handled successfully only by an experienced designer. The worst enemies of concrete, so far, are those of its friends who are ignorant of the first principles of design, and who in a misguided effort to attract attention to its virtues (and to themselves) have erected hideous structures embodying all manner of " stunts," which, while often excellent in suggestion, have been abominably fashioned. If ever there was a building material which required, more than another, the hand of an exceptionally well trained architect to bring out its salient features, that substance is concrete.

Architects are as a class conservative, for the reason that their art is the expression of the habits of the people whom they serve. The individual does not alter his mode of life from day to day nor from year to year. A nation may change its government over night, but the forces that effect the revolution have had a gradual growth. It is natural, therefore, that the architect should view with suspicion, and even dislike, a building material that from its nature requires the abandoning of many forms of design hitherto regarded as basic, and that calls for the modification of methods and revising of rules that have been fixtures in the art of architecture for centuries. The fact that concrete, and more particularly reinforced concrete, demands a new style of architecture, is a shock to our fraternity sufficient in itself to account for much of the silent and expressed hostility towards this radical newcomer. The bolder spirits of the profession, however, will

not fail to translate the handwriting on the wall as the beckoning of opportunity, and a promise of glory and fame with no mean financial reward will spur these men to achieve the solution of the problems indicated despite the failures and criticism that will accompany their initial attempts. A review of the astonishing number of recent inventions turned to practical use within a decade, largely revolutionizing thought and procedure within this short space of time — to mention only wireless telegraphy, the automobile, the aeroplane, the cash register, the talking machine, the player piano and the motion picture — leads to the conclusion that architects of force and foresight will not permit reinforced concrete to hide its light under a bushel.

Architecture which expresses the function of the object, which exhibits a logical use of the material used, and offers a pleasing proportion of light and shade, is good architecture. Reinforced concrete is quite as susceptible to such expression as any material that has heretofore been used, and promises far greater possibilities in construction and beauty than have been recorded even in the architecture of the Greeks and the Goths. It will express, as did these agencies, the spirit and needs of the people. Crude and wholly utilitarian at the beginning, concrete architecture will gradually acquire refinement and nobility as social development advances.

The author agrees with those who believe that concrete should stand for concrete, and who advocate the decoration of construction rather than "constructed decoration." In following this doctrine, the monolithic form, showing the aggregate embellished as suggested, seems to indicate a way in which the esthetic development of reinforced concrete may be carried along rational lines, and an ultimate perfection of design reached with greater facility and in less time than through the use of either steel or masonry alone. An artistic rendering of reinforced concrete will occur through a frank manifestation of its own characteristics of light-

ness, delicacy and absence of deep shadows, as well as of the purpose and function of the structure. With the employment of logical ornamentation, either molded or flat, or of superficial or incrusted polychromy, as may best serve the purpose, the truth and harmony of the whole will be clearly revealed.

Whether an American style is to be realized through reinforced concrete or some other medium, the prime factor of importance to be observed in following any style is honesty of purpose. Only through the truthful expression of aim and function, and a simple and durable structure harmonizing with the forces of Nature within it and upon it, can our architects hope to win lasting honor and fame by contributing to the evolution of an architecture worthy of the name of our great nation.

Bill 9
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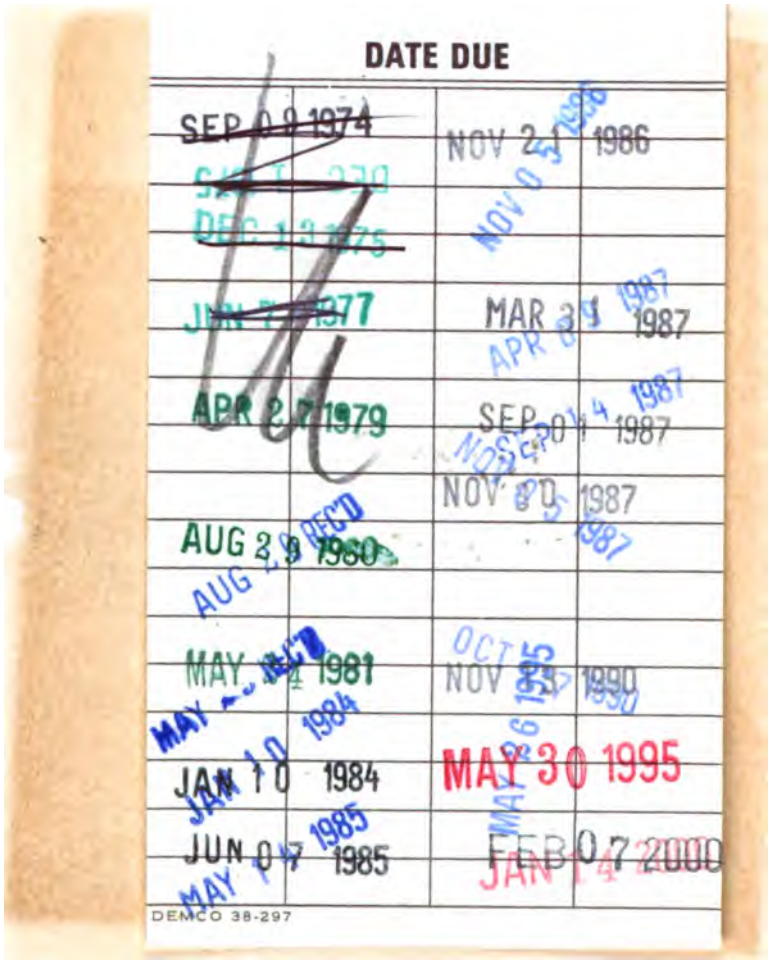

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SEP 0 8 1974	NOV 21 1986
DEC 13 1975	
JUN 7 1977	MAR 31 1987
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